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This 1998 305(b) report is the result of the combined efforts and cooperation of various Department of Environmental Quality (DEQ) programs and programs in other state agencies, as well as input and assistance from various public and private organizations. The primary information for nonpoint source assessment was collected and analyzed by the Department of Conservation and Recreation (DCR). Other water quality, health related information, was provided by the Virginia Department of Health (VDH).

The overall water quality assessments for the individual waterbody basins was conducted by the water quality planning staff in each of the DEQ regional offices. The regional ambient monitoring program staff collected and provided the primary, quality assured data used by the regional planning coordinators in their overall evaluation of water quality within each basin located within the regional boundary. The Virginia Division of Consolidated Laboratory Services (VDCLS) analyzed the ambient station samples and provided the results to the regional office for inclusion into the water quality database. Additional fish tissue and sediment samples were collected by the DEQ Standards and Research program. Analysis of these samples are provided by the College of William and Mary/Virginia Institute of Marine Sciences and the results are also incorporated into the overall basin assessments. The DEQ Chesapeake Bay program provided sampling data which was incorporated into the overall coastal and estuary assessment. The DEQ Wetland and Groundwater programs provided valuable insight into each programs impact on water quality issues, while the DEQ Construction Assistance program provided cost/benefit analysis information. The DEQ Water Quality Assessment staff at the central office assisted with much of the final preparation and review of the contents of this report as well as production of the report cover.

Many other sources provided information used in the overall assessment of water quality in Virginia. These contributors include local governments, regional agencies and various citizen groups interested in water quality issues. Information provided by the DEQ Pollution Prevention program has assisted numerous public, private and industrial organizations with pollution prevention techniques and incentives for pollution reduction which ultimately results in improved water quality.

Finally, specific monitoring data and other summary and/or procedural information was provided by several federal programs. These include the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service and several sections within the Environmental Protection Agency.

It is with my greatest sincerity that I acknowledge the appreciation each contributor deserves for their assistance in preparation of this report. Without your assistance, this 305(b) water quality assessment report could not have been completed.

My thanks to all contributors,

Harry H. Augustine, III
Virginia 305(b) Coordinator

INTRODUCTION

The 1998 Virginia Water Quality Assessment Report is a summary of the water quality conditions in Virginia during the past five years (July 1, 1992 - June 30, 1997). This report is submitted to the Environmental Protection Agency and Congress to satisfy the federal reporting requirements under Section 305(b) of the Clean Water Act.

Summary information on water quality and the programs developed by the Department and other state agencies to assess and protect water quality and human health have been incorporated in this report. Detailed information on the nine river basins found in Virginia are not presented in this report. This information, however, is maintained for each watershed in a computerized database at DEQ. Specific information can be retrieved upon request by contacting the DEQ's central or local regional office.

Several "structural" modifications have been made to this report in an attempt to make it easier to understand by providing specific summary information about the water quality assessment programs and the subsequent quality of the waters assessed.

Along with the structural modifications to the report, several aspects of the assessment process have changed from previous assessments. First and foremost, the overall assessment of water quality has gone to a five year period. Previous assessments were based on a two year period which made it difficult to accurately predict water quality because the number of sampling data points available were limited. By going to a five year assessment period, more data points are available and a better statistical analysis of the data can be performed. Secondly, the use of the "fully supporting but threatened" category has been modified and greatly increased to include Department of Conservation and Recreation (DCR) "high ranking" watersheds, DEQ designated "nutrient enriched waters" (9VAC 25-260-350) and shellfish waters with temporary harvesting restrictions. Due to the many judgmental assessment factors involved with the threatened category, three subcategories of fully supporting but threatened waters, each having a ranking priority, are being developed. One of the main benefits from this approach will be the ability to "focus" the monitoring program into these threatened waters using the priority ranking process. Finally, EPA and state guidance for the delineation of assessed stream miles has provided a more consistent method to determine the number of stream miles associated with each ambient sampling station. Generally, the mileages associated with each monitoring station and the data collected have been reduced, thus reducing the total miles of monitored waters.

The structural and procedural modifications previously noted, result in an increased number of samples required for assessment purposes, a minimum of 13. This means newly created sampling stations which collect quarterly data may not have sufficient data to make an assessment. In these cases, the assessment is classified as "reserve judgement" due to insufficient data unless preliminary data indicates water quality problems, where the threatened category could be appropriate. This reserve judgement category is not included in the total miles assessed as a final assessment is pending, due to the need for additional data. As a result, this new assessment procedure results in a reduction in total miles assessed but does not mean that monitoring has decreased.

In addition to the previously described changes in 1998 water quality assessment process, the 305(b)/303(d) guidance manual has been revised and updated in an attempt to enhance assessment quality and consistency among the regional offices. The revised manual is currently being reviewed by an academic advisory committee (AAC) made up of academic advisors from several state universities who are familiar with water quality issues. The purpose of this committee is to review the procedures associated with water quality assessment and provide comments back to DEQ concerning any technical issues the committee feels may need additional revision or clarification. DEQ has also made this guidance document available to the public for comment and additional revisions from this review process may be necessary.

In July 1997 the Department established the Water Quality Monitoring Task Force. The purpose

of the Task Force is to update the water quality monitoring program to conform with the monitoring requirements of the Water Quality Monitoring, Information, and Restoration Act of 1997. The Task Force has analyzed the current operational plans of the various monitoring programs within the Department and has begun implementation of a two year project to revise the overall monitoring strategy. The expected outcome of this effort will be more consistent station siting, greater stream mile coverage, and expanded pollutant analyses so the overall water quality can be determined within specific and easily identifiable, geographically defined water segments.

To accomplish the goal of increasing the number of stream miles monitored, the Department's newly established volunteer monitoring program has begun the role of coordinating the monitoring activities of participating volunteer groups. Consistent quality control practices and quality assurance procedures within the volunteer monitoring programs will ensure the creditability and precision of the volunteer data for use in the "monitored data" assessment process.

Alternative station siting selection criteria are being explored as a basis for expanding river miles monitored. Historical monitoring station selection is being used to determine any need for additional monitoring in those waters known to have water quality problems.

Expanded pollutant analysis is currently being conducted by using new techniques developed by the Department. These include clean metals monitoring, additional pathogenic bacteria monitoring, and pilot projects for trace organics in whole water column analyses.

The pending results of the long term water quality trend analysis being conducted by Virginia Polytechnic Institute and State University (VPI&SU) should provide additional insight for the monitoring program Task Force and will likely affect future monitoring site location, coverage, and parameter selection.

Another evolving aspect of the 1998 water quality assessment involves the expanded sampling and analysis for a relatively unknown microorganism *Pfiesteria piscicida*. This microorganism has been linked to extensive fish kills in North Carolina estuaries. Leading experts from North Carolina State University and the Florida Department of Environmental Protection have not identified the toxic microbe in samples from Virginia. However, *Pfiesteria piscicida* was found in several Maryland rivers with fish kills during the summer of 1997. Since data associated with this sampling program have only begun to be collected, the actual water quality impacts are still being reviewed. Therefore, the Department has reserved judgement on water quality issues associated with *Pfiesteria*. Additional information is provided in Chapter 2.5 of this report.

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Chapter 1.1 EXECUTIVE SUMMARY

The 1998 305(b) Water Quality Assessment Report describes the water quality conditions in the Commonwealth of Virginia during the time period beginning July 1, 1992 through June 30, 1997. The primary purpose of this report is to satisfy the Department of Environmental Quality's (DEQ) federal water quality reporting requirements under Sections 305(b), 106, 314 and 319 of the Federal Clean Water Act. It also serves to supplement the water quality assessment requirements associated with Virginia Senate Bill §1122 (Water Quality Monitoring, Information and Restoration Act).

Virginia has nine major river basins with an estimated 49,350 miles of perennial rivers and streams and approximately 2,500 square miles of estuaries. These figures were calculated utilizing the Environmental Protection Agency (EPA) River Reach File Version 3 (RF3).

Virginia's overall water quality is assessed based on the ability of the citizens to safely enjoy the designated uses of the waters as described in the DEQ water quality standards. Table 1.1-1 briefly describes the designated uses and the baseline criteria used to support the designated uses.

Table 1.1-1 DESIGNATED USE MATRIX

NO.	DESIGNATED USE	SUPPORT OF USE DEMONSTRATED BY
1	Aquatic Life Use	Conventional Pollutants (DO, pH, Temp.); Toxic contaminants in water column; Toxic contaminants found in fish tissue and sediments; Biological evaluation.
2	Fish Consumption Use	Advisories and restrictions issued by VDH.
3	Shellfish Consumption Use	Restrictive actions for harvesting and marketing of shellfish resources made by Div. of Shellfish Sanitation of VDH.
4	Swimming Use	Conventional Pollutant (Fecal Coliform Bacteria) and/or beach closures issued by VDH
5	Public Water Supply Use	Closures or advisories by VDH.

Surface Water Quality

The assessment of surface waters and their ability to support the designated use(s) is based on two different categories of water quality information: **monitored data** and **evaluated data**. "Monitored" data comes primarily, from monitoring station samples DEQ has collected, analyzed and stored in the Environmental Protection Agency's (EPA) STORET database. This data includes the analysis of conventional and toxic water column samples, fish tissue samples, sediment samples and biological assays. Where monitoring data are not available, an "evaluation" is made, wherever possible, of the attainment of the individual uses found in the water quality standards. These evaluations are based on data associated with land use, point source discharges, nonpoint source pollution potential, fishery information, staff knowledge, and any other relevant water quality information.

The number of monitoring stations providing sampling data during the five year period was 1,620 stations. In previous years, most monitoring stations in Virginia were established to document known or suspected discharge problems or "targeted" monitoring for point source dischargers. The result of this station siting method was to "focus" on known water quality problem areas. Recently, DEQ has become increasingly aware of potential, unknown, nonpoint source water quality contamination and has moved some point source targeted stations to include random stations in seemingly non impacted areas. The intent of this change in monitoring strategy is to produce a more accurate and balanced portrayal of the

state's overall water quality conditions and attempt to better understand the impacts associated with various point source and nonpoint source influences.

This report presents the results of the assessment of water quality in approximately 19,260 miles (39.0%) of the total 49,350 miles of free flowing streams and rivers. The overall goal of the assessment program is to identify problem waters and to design and implement a water quality management plan to return the waters to their designated uses as described in the water quality standards. Of the river miles assessed, 8,587, (44.6%) fully support all assessed uses, 8,062 (41.9%) fully support all assessed uses but are threatened for at least one use, and 2,605 (13.5%) are impaired for one or more uses.

As in previous reports, the "fully supporting but threatened" category has been used. This category is used to describe a particular designated use that fully supports that use now but, based on evaluated or other related data, especially those associated with nonpoint source impacts, may not in the future. For the 305(b) report, Virginia uses this category to describe waters designated as "nutrient enriched" and nonpoint source "high priority" waters as well as waters where water quality standards have not had enough violations or data points to be listed as impaired using the binomial assessment method (as described in Chapter 3.2). As part of the ongoing assessment process, these threatened waters will assist the monitoring program in station siting and better, more conclusive, assessment data should be the result.

In general, fecal coliform bacteria exceedances are the leading cause of non or partial support of designated uses in rivers and streams. Agricultural practices appear to be one of the primary sources causing the loss of designated use support. Indications are present that uncontrolled agricultural and pasture land use results in much of the fecal coliform bacteria and nutrient contamination in Virginia's waters. However, urban runoff, as well as municipal and industrial dischargers, are also significant contributing sources. Impaired waters due to naturally occurring conditions are also included in the 305(b) report.

Designated uses were determined to be fully supporting for 623 square miles (25.8) of the 2418 square miles of Virginia's estuarine waters assessed for this report. Fully supporting but threatened accounts for 1,359 square miles (56.2%) and 437 square miles (18.1%) were assessed as impaired for one or more uses. The primary causes of impairment in Virginia's estuarine waters were benthic impairments primarily due to naturally occurring low dissolved oxygen events and fecal coliform bacteria associated with shellfish consumption advisories. The primary sources of impairment are VDH shellfish advisories and low dissolved oxygen events which occur during warmer weather especially in the deeper waters.

Based on available information, all of Virginia's 120 miles of the Atlantic Ocean Coastal Waters were evaluated as fully supporting Virginia's designated uses.

Public Health/Aquatic Life Concerns

Increasingly, DEQ is addressing the role toxic pollutants play in reducing water quality. DEQ supports programs to monitor, evaluate, and alleviate toxic impact on aquatic life and human health. This report describes programs, now in place, that address toxicity in state waters. DEQ has increased the number of stations within the Ambient Water Quality Monitoring (AWQM) network where water column and sediment samples are collected for toxics analysis.

The Virginia Department of Health (VDH), Bureau of Toxic Substances has established five health advisories and one restriction currently in effect for fish consumption on 235 miles of the Commonwealth's streams and waterways and on approximately and 222 (tidal river) estuary square miles in the James River. The remaining advisories/bans are as follows:

- 80 miles of the North Fork Holston River are restricted to catch-and-release fishing due to mercury pollution.

- 103 miles of the South River and S.F. Shenandoah River are under a fish consumption restriction due to mercury pollution. VDH advises that no more than one meal per week of fish from these waters be consumed and further advises that small children and pregnant women should not eat any fish containing mercury.
- 45 miles of the South Fork Shenandoah River, North Fork Shenandoah River, and the Shenandoah River are under a fish consumption advisory due to PCB contamination.
- The tidal James River and all tributaries from the fall line at Richmond to the Hampton Roads-Norfolk Bridge Tunnel are under a fish advisory due to the presence of the pesticide Kepone in the sediments.
- A 56 mile fish consumption advisory, based on PCB contamination, was posted in July 1998 in the Roanoke River from Seneca Creek (Route 704 near Long Island) to a pipeline crossing the Roanoke River adjacent to Route 803 in Halifax County and Route 633 in Charlotte County.
- 7 miles of the Blackwater and Nottoway Rivers were under a fish consumption advisory due to dioxin contamination. **This advisory has recently been removed.**

In addition to the information on VDH fish consumption advisories and bans, another evolving aspect of water quality assessment which has potential public health implications, involves fish kills caused by a relatively unknown microorganism *Pfiesteria piscicida*. Additional information concerning this aspect of water quality assessment can be found in Chapter 2.5.

Lake Water Quality Assessment

Virginia has 104 significant (public water supply and/or > 100 acres), publicly owned lakes and reservoirs with an estimated 149,982 total acres. Of these, 140,080 (93.4%) acres were assessed during the reporting period. Of the acres assessed, 62,730 acres (44.8%) assessed were fully supporting. 77,342 acres (55.2%) were threatened for at least one designated use. There were no acres impaired. The majority of the threatened waters were related to the recent PCB fish consumption advisory in the Roanoke River. Dissolved oxygen (DO) depletion, possibly associated with excess nutrients, and siltation from nonpoint source influences were also identified as causes for certain lakes being assessed as threatened.

Control of lake pollution is implemented through the following initiatives: the Clean Lakes Program; the application of VDH public water supply and nutrient analysis; the ban on detergents containing phosphorous; and the control of nonpoint source pollutants through Best Management Practices (BMPs).

Chesapeake Bay Program

In 1983, Virginia, Maryland, Pennsylvania, the District of Columbia, EPA and the Chesapeake Bay Commission formally agreed to undertake the restoration and protection of the Bay using a cooperative Chesapeake Bay Program approach and established specific mechanisms for its coordination. Reaffirming and expanding this commitment resulted in a new Bay Agreement signed in 1987. The new agreement contained goals and priority commitments in six areas: living resources; water quality; population growth and development; public information, education and participation; public access; and governance. A bay goal in the area of water quality is to reduce, by the year 2000, the annual load of nitrogen and phosphorus reaching the Bay from controllable sources by 40%.

To achieve the goals of the 1987 Chesapeake Bay Agreement, a basin wide Nutrient Reduction strategy and a basin wide Toxics Reduction strategy were developed. The Chesapeake Bay Office at the Virginia Department of Environmental Quality has developed the following programs to meet the commitments of these two strategies:

Voluntary Nutrient Monitoring Program: This program collects and analyzes nutrient data from major municipal and industrial treatment facilities.

Discharge Monitoring Report Program: Provides reports of nitrogen and phosphorus levels in the effluent of all facilities with nutrient limits or discharging to waters designated as "nutrient enriched".

Special Studies: Collected more detailed data on the particulate nutrient forms being discharged by Bay area treatment facilities.

Phosphate Detergent Ban: The P-Ban, which has been in effect since 1988, prohibits the use, sale, manufacture or distribution of any cleaning agent that contains more than zero percent phosphorus by weight.

Point Source Policy for Nutrient Enriched Waters: This policy was adopted to reduce the discharge of phosphorus into state waters, and in conjunction with the P-Ban, has reduced, by 52%, the Bay's phosphorus levels from 1985 to 1996.

Biological Nutrient Removal: Provides incentives for upgrades of treatment plants to incorporate this advanced treatment process.

Water Quality Standards for Ammonia: Water Control Board adopted stringent water quality standards in 1992 for ammonia nitrogen in fresh and salt water.

Time Variable Model: Developed a 3-D computer model to computer model to provide a simulation of nutrient inputs to the Chesapeake Bay and its tributaries.

Basin Specific Nutrient Reduction Strategies: Strategies to reduces nutrient loads in the Bay's tributaries.

Chlorine Discharge Control: Awards grant money to municipal wastewater treatment facilities to assist in reducing their chlorine discharge to the Bay.

Toxics Loading Inventory: Develops an inventory to estimate the total point and non-point source loadings of toxic substances to the bay.

Water Quality Standards for Toxics: Water quality standards are designed to protect aquatic life, wildlife and human health by designating the use or uses of a waterbody (i.e. fishable, swimmable) and establishing narrative as well as numerical criteria necessary to protect these uses. Forty six numerical standards for toxics and conventional pollutants are designated to protect aquatic life and/or wildlife. Seventy three numerical standards are designated to protect human health via public water supply and fish consumption.

VPDES Permit Program for Toxics: This program evaluates permits to be reissued and new applications with respect to toxic standards.

Toxicity Reduction Evaluation: This process identifies specific chemical or toxicant groups responsible for effluent toxicity, and evaluates and implements treatment alternatives to reduce toxicity to acceptable levels.

Pretreatment Program: The pretreatment program's primary purpose is to protect publicly owned treatment works (POTW'S) and the environment from the adverse impact that can occur when toxic waste are discharged into municipal wastewater systems that are not designed to treat such waste.

Storm Water Management Program: This program has established regulations requiring permit applications for storm water discharges from municipal storm sewers serving a population of 100,000 or more and for storm water discharges associated with industrial activity.

Water Quality and Habitat Monitoring Program: This program assesses trends in water quality and organism abundance throughout Virginia's portion of the Bay and its tributaries.

In addition to these activities, DEQ has been involved in a study of the water quality in the Elizabeth River. Phase I of this study focused on the monitoring of water, sediment and biological quality in the river system. Phase II was initiated in 1990 and was designed to: determine the effectiveness of management actions, identify pollutants of concern in the water column and in sediments, aid in the development of toxic standards, and improve our understanding of the processes that control water and sediment quality. Additional information on the Bay program can be found in Chapter 3.6 of this report.

Wetlands Information

Virginia currently has approximately 1,044,900 acres of wetlands, found mostly in the Coastal Plain province within the state. The majority of these acres are freshwater non-tidal systems. Only about 23% are tidal saltwater. The loss of freshwater wetlands, until the year 1977, had been caused mostly by agricultural conversion; channelization; and pond, lake and reservoir development. Urban development was the primary cause of the loss of estuarine wetlands. Although wetlands trends are known up to the late 1970's, there has been no estimation of additional losses since that time.

Among the wetlands legislation that has been enacted in Virginia over the last twenty years are the Wetlands Act of 1972, which allows local wetlands boards to issue wetlands development permits, and the Chesapeake Bay Preservation Act, which created the Chesapeake Bay Local Assistance Department to oversee the development of Chesapeake Bay Preservation areas by local governments.

In 1990, the General Assembly passed legislation to establish the Virginia Water Protection Permit Program.

Ground Water Quality

Ground water programs in Virginia strive to maintain the existing high water quality. The Virginia Ground Water Protection Steering Committee (GWPSC), established in 1986, continues to meet bi-monthly as a vehicle for sharing information, for directing attention to important ground water issues, and for taking the lead on ground water protection initiatives requiring an inter-agency approach. This inter-agency advisory committee is designed to stimulate, strengthen, and coordinate ground water protection activities in the Commonwealth. Ground water protection activities in the Commonwealth are as varied as the funding sources that support them.

Point Source Control Program

Control of Point Sources is managed through the DEQ's Virginia Pollutant Discharge Elimination System (VPDES) Permit Program, Toxics Management Program, and Pretreatment Program. The Virginia Pollutant Abatement Program addresses facilities that handle waste or waste waters, but does not involve discharging to a sewage treatment facility or state waters. These programs have been established to monitor and limit the discharge of conventional and toxic pollutants.

Water quality planning involves the development of Water Quality Management Plans to control both point and nonpoint sources of pollutants to state waters. Water Quality Management Plans include, when necessary, total maximum daily load (TMDL) limitations or strategies to restore water quality.

Nonpoint Source Control Program

DCR has statewide responsibility for coordinating Section 319 nonpoint source (NPS) programs and activities in the state, including development and implementation of the state NPS management program. The strategy used in this program revolves around the use of Best Management Practices (BMP's) for agricultural activities.

Cost/Benefit Programs

Construction Assistance Program. Since 1958, Virginia has received \$1.2 Billion in federal appropriations. These federal funds financed up to 75% of the total eligible costs of approximately 183 projects. The state contributed another \$52.3 Million with the remainder coming from local sources. Local investment is estimated at approximately \$500 Million.

Virginia Revolving Loan Fund. In 1986, Virginia created the Virginia Water Facilities Loan Fund to provide low cost loans to local governments for wastewater treatment improvements. From 1988 to 1995, Virginia has received \$301,748,178 in federal capitalization grants. In addition, the General Assembly has appropriated \$61,406,546.

Funds through Virginia's loan program have eliminated 12 primary dischargers, upgraded or replaced 22 inadequate lagoons, upgraded 70 outdated treatment facilities, improved water quality at 27 locations by reducing infiltration and inflow, addressed 18 potential health hazard situations by eliminating raw sewage discharges and failing septic systems and provided design grants for the elimination of 2 remaining municipal primary wastewater treatment facilities.

Surface Water Quality Monitoring Programs

The Ambient Water Quality Monitoring Program included 1,620 monitoring stations during this assessment period. Of these stations, 1349 stations are sampled for chemical and physical parameters on a variable basis to determine water quality conditions. The remaining 271 stations were used for biological monitoring. Approximately 39,000 samples were collected to perform a multitude of various analyses. A "special study" subset of monitoring stations form the Fish Tissue and Sediment Characterization Monitoring Program. These stations are sampled for pesticides, metals and organics in fish tissue and sediment on a three year revolving cycle. These stations include some previously established ambient and biological water quality stations along with separate, independent stations . Each biological station sampled during the cycle was sampled to determine the health of the bottom dwelling invertebrate population and the ability of streams to support a balanced aquatic community. Fish tissue monitoring stations are sampled and used as a health screening analysis for any potential fish consumption problems.

Summary

In summary, the water quality information made available to DEQ from the programs described above are used to assess the success and effectiveness of the water quality control program as well as the quality of the waters within the Commonwealth. The goal of the water quality control program is to assess all surface waters and attain water quality to support all designated uses of the waters in the Commonwealth.

Chapter 2.1 STATE BACKGROUND INFORMATION

Population

The Commonwealth of Virginia covers 40,741 square miles, ranking 36th among the states in size. This area is divided into six Department of Environmental Quality (DEQ) regional offices and two satellite offices (Figure 2.1-1). According to the most recent census (1994), the population of the Commonwealth was estimated to be 6,551,500; 2.5% of the total United States population. It has grown 18.3% between 1980 and 1994, ranking 12th nationally, and continues to grow. About 72% of all Virginians live in eight metropolitan areas; Northern Virginia, Norfolk-Virginia Beach-Newport News, Richmond-Petersburg, Roanoke, Lynchburg, Charlottesville, Danville, Johnson City-Kingsport-Bristol. Nine percent of the population lives in seven smaller urban areas and 19% live in rural areas.

Geography

Virginia is over 400 miles wide along its southern boundary, reaching from the Atlantic Ocean in the east, crossing the eastern continental divide into the Mississippi Basin to the west. Along the way, Virginia crosses five physiographic provinces (Figure 2.1 -2). The southwestern edge of the state touches upon the margin of the Cumberland Plateau, rugged terrain with formations of sandstone and shale. Virginia's coal mining industry is concentrated in this area. The Valley and Ridge province encompasses the long, parallel ridges of the Appalachian Mountain chain in western Virginia. Erosion resistant quartzites and sandstones form the ridgetops, while streams have carved valleys into the softer limestones and shales. The narrow Blue Ridge Mountain province is made up of hard greenstone, quartzites, and granites, igneous and metamorphic rocks that originated as ancient lava flows. These mountains are among the oldest on earth. East of the Blue Ridge Mountains lies the rolling Piedmont of central Virginia. This area is underlain by a complex of igneous and metamorphic rocks. The Triassic Basins, ancient down-faulted basins filled with sedimentary rocks and igneous intrusions are major sub-units of this province. A distinctive fall line, marked by waterfalls and rapids across the major rivers, divides the Piedmont from the Coastal Plain. Virginia's flat Tidewater area consists of deep, unconsolidated deposits of sand, gravel, fossil shells, and clay. The basement formation of granite, exposed at the fall line, is buried under 2,900 feet of sediment at the Atlantic Coast.

Water Resources

A summary of Virginia's water resources is provided in Table 2.1-1. Virginia has an estimated 49,350 miles of streams and rivers divided into nine major basins (Figure 2.1 - 3). This estimate represents mileage determined by EPA's River Reach File 3, the Digital Line Graph database as well as estimates from Virginia's Stream Gazetteer. Annual rainfall averages almost 43 inches. Total combined flow of all freshwater streams in the state is estimated at about 25 billion gallons per day. The 248 publicly owned lakes in the Commonwealth have a combined area of 162,230 acres. Three large impoundments (Lakes Gaston, Kerr, and Smith Mountain) account for two-thirds of this total. Many thousands of other small, privately held lakes and ponds, some of significant size, dot the landscape.

Other significant water features of Virginia include approximately 236,900 acres of tidal and coastal wetlands, 808,000 acres of freshwater wetlands, 120 miles of Atlantic Ocean coastline, and over 2,500 square miles of estuaries. Virginia's highly indented shoreline, including the Chesapeake Bay and its sub-estuaries, is conservatively estimated to be 3,315 miles long.

Table 2.1 - 1 Virginia Water Resources Atlas

State Population (1994 census) - 6,551,500		
State Surface Area - 40,741 square miles		
Major River Basins		
Potomac/Shenandoah James York Roanoke Chowan/Dismal Swamp	Tennessee/Big Sandy Chesapeake Bay/Small Coastal Rappahannock New	
Perennial River Miles	49,350	
Total Non-Tidal Stream Miles	49,350	
Miles of Border River (Potomac) - 180		
Publicly-Owned Lakes and Reservoirs	<u>Number</u>	<u>Acres</u>
Greater than 5,000 acres	5	109,838
Less than 5,000 acres	243	52,392
Total	248	162,230
Acres of Freshwater Wetlands - 808,000		
Acres of Tidal and Coastal Wetlands - 236,900		
Estuary Square Miles - 2,500		
Atlantic Ocean Coastal Miles - 120		
Total Coastal Shoreline Miles, including Chesapeake Bay and Tidal Tributaries to a Width of 110 Feet - 3,315		
Statewide Average Annual Rainfall - 42.8 inches		
Average Freshwater Discharge of All Rivers - Approximately 25 billion gallons per day		

Land Use

Virginia's landscape is dominated by its forests, covering approximately 55.6% of its total area (Table 2.1-2). However, according to the Virginia Department of Forestry, a loss of commercial forest and cropland has contributed to an increase in urban land from 10.4% to 14.8% from 1991 to 1995.

The second most prevalent land use in Virginia is agriculture, covering 25.9 percent of the State's total land area. Cropland accounts for 2,903 square miles, about 7.1 percent of the State's total area; pasture and hay production accounts for 6,845.3 square miles, or about 16.8 percent of

the State's land. The remaining 6,029 square miles of land area, about 14.8 percent of the State,

Land Use

Commercial Forests	20,058.6 mi ²	49.2%
National Forests	2,550.0 mi ²	6.4%
Total Forested Land	22,608.6 mi²	55.6%
Cropland	2,903.4 mi ²	7.1%
Pasture/Hay	6,845.3 mi ²	16.8%
Other	828.1 mi ²	2.0%
Total Agricultural Land	10,576.8 mi²	25.9%
Other (Including Urban)	6,029.1 mi²	14.8%
Total Land Area	39,214.5 mi ²	96.3%
Inland Waters	1,526.4 mi ²	3.7%
Total Area	40,740.9 mi²	100.0%

includes urban areas. Inland waters account for the remaining 3.7%.

In summary, Virginia is fortunate to have abundant, diverse water resources. However, changing land use patterns and an expanding urban population are bringing new challenges to water pollution control. Clean water is a valuable resource to the citizens of the Commonwealth. The following chapters of this report describe existing water quality, and the various programs which are responsible for its protection and ultimate improvement.

Chapter 2.2 WATER POLLUTION CONTROL PROGRAMS

Virginia Pollutant Discharge Elimination System (VPDES)

The Commonwealth of Virginia has operated a successful state discharge permit program since 1946. To supplement state programs, the Federal Water Pollution Control Act was passed requiring a uniform permit program nationwide, allowing all States to uniformly control industrial and municipal wastewater discharges. Some states elected to have the federal government manage their permit program. Virginia requested delegation of authority from EPA to administer its own permit program in conformance with VPDES (formally NPDES) regulations. In April 1975, Virginia was delegated the authority to administer the VPDES permit program.

VPDES permits establish limits on the quantity and/or concentration of pollutants allowed in the discharge. The VPDES permits implement the applicable requirements of federal effluent guidelines, as well as the Virginia Water Quality Standards. Effluent limits are written to assure the most appropriate of these regulations is applied to the discharge. The permittee must monitor the quality of the effluent and report the results to the DEQ. The permit also requires the facility to be properly operated and maintained. Conditions requiring pretreatment programs are included in permits for publicly owned treatment works (POTWs) that are subject to this program. Other VPDES permits may contain requirements related to the control of pollutants in storm water.

The Toxics Management Program, (TMP) which is discussed in detail elsewhere in this report, is also implemented through the VPDES permits. DEQ is utilizing the concept of general permits to streamline the permitting process and conserve resources of both the permittee and DEQ.

Municipal Facilities

Currently 5,770 VPDES permits are in force in Virginia. Approximately 1,385 of these are general permits for sewage discharges less than or equal to 1,000 gallons per day. These permit holders are required to monitor their discharge and report the results to DEQ. There are 92 "major" municipal dischargers, discharging at least one million gallons per day (mgd). Major facilities range in size from one to 70 mgd and treat about 90 percent of all the sewage in Virginia.

Industrial Facilities

There are 587 industrial dischargers currently permitted in the state. Of these, 59 are major facilities. Facilities are assigned major and minor status annually through an agreement between the EPA and the DEQ.

General Permits

General permits are written for a general class of dischargers. Virginia was granted general permit authority from EPA in May, 1991. The impact of General Permits has streamlined the VPDES permit process, and reduced the paperwork, time and expense of obtaining a permit. It has also allowed staff resources to be concentrated on permits which have the greatest potential for impacting water quality. The processing of general permits requires the submittal of a Registration Statement. Upon staff review and acceptance of the Registration Statement, a General Permit is sent to the owner. Currently seven types of general permits, are available in Virginia: Corrective Action Plan, Confined Animal Feeding Operations, Storm Water, Nonmetallic, Mineral Mining, and Domestic Sewage Discharges less than or equal to 1,000 gallons per day and Non-Contact Cooling Water dischargers. Other General Permits in various stages of development are: Seafood Operations; Car Wash dischargers; and Ready Mix Concrete Operations (pending).

There are 4,397 dischargers covered by the general permits in force in Virginia. Of these permits, 2,758 have received coverage under one of the four Storm Water General Permits. Storm

Water General Permits are available for light and heavy manufacturing facilities; transportation facilities, landfills, power plants, recycling facilities; and construction sites.

Fees For Permits And Certificates

The DEQ has adopted Regulation VR 680-01-01 which establishes fee schedules for Permits. The assessment of fees is a requirement of Section 62.1-44.15:6 of Article 2.1 of the State Water Control Law enacted by the 1992 General Assembly. The assessment of fees allows DGIF, DCR, and DEQ to recover a portion of the cost of processing applications for permits or Certificates which DEQ has the authority to issue.

Fees have been established for VPDES, Virginia Pollution Abatement (VPA), Virginia Water Protection (VWP), Corrective Action Plan (CAP), Surface and Ground Water Withdrawals, and General Permits. Agricultural operations are exempt from payment of permit application fees. Fees may range from \$200 for a general permit to \$8,000 for a VPDES "Industrial Major" permit. There are also fees for modifications and waivers.

Toxics Management Program

Requirements for toxics monitoring are written into VPDES permits as special conditions. These monitoring requirements are developed by the DEQ Toxics Management Program (TMP), which originated in the early 1980's. Since November 1988, the program has been driven by Virginia's Toxics Management Regulation (VR 680-14-03). The aim of the program is to involve all industrial and municipal VPDES permit holders that potentially discharge toxic pollutants into a systematic program of biological testing. This testing is designed to identify wastewater discharges that are toxic to aquatic life.

The need for a TMP is determined at the time of permit issuance, reissuance, or modification, using information provided by the permittee as part of the VPDES permit application, as well as additional data generated by the DEQ or other sources. Generally TMP special conditions include quarterly chronic and/or acute toxicity testing for a period of one year using vertebrate and invertebrate species. Once the TMP data have been generated for a particular outfall, they are evaluated according to the following decision criteria specified by the Toxics Management Regulation:

1. The effluent test results must demonstrate no acute toxicity in at least 75% of the tests performed.
2. The effluent test results must demonstrate that no chronic toxicity would be predicted in the receiving stream under low flow conditions in at least 75% of the tests performed. (Chronic toxicity testing is only applicable to effluent predicted to make up at least 1% of the receiving stream during low flow conditions).

If an effluent passes decision criteria 1 and 2 above, annual toxicity testing is usually required for the remaining life of the permit. If an effluent demonstrates acute and/or chronic toxicity by failing criteria 1 and/or 2 above, the permittee is required to perform a toxicity reduction evaluation (TRE) and a whole Effluent Toxicity limit is developed for the VPDES permit. A TRE is a process for identifying specific toxicants or toxicant groups responsible for the effluent toxicity, and for evaluating and implementing treatment alternatives to reduce the toxicity to acceptable levels.

Pretreatment Program

The Pretreatment Program controls industrial discharges to POTWs. These municipal sewage treatment plants are not designed to treat toxic industrial wastes. Such wastes may interfere with the plant's biological treatment processes, pass through them untreated into receiving waters, or contaminate POTW sludge to the extent that lawful disposal is precluded. The control authorities for

the POTWs are charged with the responsibility of controlling their industrial users. Oversight and regulation of the POTW pretreatment programs was delegated to the DEQ by EPA on April 14, 1989.

There are 32 POTW authorities in Virginia with approved pretreatment programs. These authorities control 63 separate permitted treatment facilities. Pretreatment programs for three other authorities have been submitted for review or are under development. Requirements for sewer use ordinances, surveys of industrial users, or implementation of approved pretreatment programs are currently being incorporated into municipal VPDES permits.

Standards imposed on industrial users include general standards, prohibitive discharge standards, categorical standards, and local limits developed by POTWs. General standards are narrative prohibitions against pass-through and interference, applicable to all industrial users. Prohibitive discharge standards are also applicable to all industrial users and include limitations on parameters such as pH and temperature, measured in industrial discharges. Categorical standards are federal technology-based standards developed for certain categories of industries discharging to POTWs. In addition, POTWs are required to develop local limits for substances that have the potential to cause interference with treatment or pass through in toxic amounts to receiving waters.

A total of approximately 140 industries subject to federal categorical pretreatment standards are known to discharge to the POTW authorities noted above. In addition, there are approximately 200 other industries which are considered significant dischargers to these POTWs. These industries are classified as such by having process wastewater flows of at least 25,000 gpd.

The DEQ regional office personnel conduct audits of POTW pretreatment programs and inspections of their significant industrial users. They also inspect 13 additional categorical industrial users in small municipalities developing pretreatment programs or with unapproved programs. These users are controlled through municipal ordinances, and are required to self-monitor and report biennially to the municipality, which then reports to DEQ. The regional offices also review various pretreatment-related submittals from the POTWs.

Personnel at the DEQ central office write regulations, issue guidance, and provide technical support for the state Pretreatment Program. They serve as a secondary level of review for all major pretreatment program submissions, and provide guidance, technical assistance, and training to the regional and enforcement personnel. A "Pretreatment Procedures Technical Manual" has been developed, and is updated as part of this effort, in order to provide a central source of guidance to the regional offices and pretreatment POTWs. The central office section also updates required data elements for EPA's Permit Compliance System from information gleaned from POTW audits and annual reports.

The Virginia Compliance Auditing System

The DEQ monitors the performance of municipal and industrial dischargers through a computerized Compliance Auditing System (CAS), which was instituted in September 1987. Under the VPDES permit program, major facilities are required to submit monthly plant performance reports based upon self-monitoring of the parameters listed in the discharge permit. Minor facilities report on an individually assigned frequency. These discharge monitoring reports (DMRs) indicate the quality of plant effluent and whether any bypasses have occurred. Data from the DMRs are entered into the CAS in the regional offices, which compares all parameters to permit limits to detect any permit violations.

When a permit violation is observed through the CAS, the system assesses weighting points according to the severity and frequency of the violation. In addition to the automatic detection of permit effluent violations through the automated CAS, compliance schedules, both in permits and enforcement actions as well as other required due dates, are tracked through other databases and weighting points assigned for violations. Weighting points are also assigned for single event violations

reported to the DEQ by permittees, the public or other sources. All weighting point values are assessed and tallied for the previous six months. When accumulated values exceed specified limits enforcement action may be initiated if compliance cannot be immediately achieved. Enforcement action may also be initiated any time a violation is observed which is determined to cause environmental harm. Additional enforcement activity may result from problems discovered during on-site inspections.

The accumulated records of weighting point values are used by both Regional Office and Central Office staff as a tool to aid objective focus when determining appropriate enforcement activity with facilities in habitual permit noncompliance and on those facilities with the greatest potential for environmental harm. The program also ensures that permittees are fully aware of problems as they develop and have an opportunity to improve treatment in order to maintain compliance .

Virginia Pollution Abatement Permits

A Virginia Pollution Abatement (VPA) Permit may be issued by the SWCB whenever an owner handles waste or wastewaters in a manner that does not involve discharging to a sewage treatment facility or to state waters pursuant to a valid VPDES permit. Pollution abatement facilities approved through the VPA permit program may include pits, ponds, and lagoons for waste storage, treatment, or recycling. Permits are also required for on-site facilities, such as land treatment systems. The basis for approval for such systems includes assurance that waste or wastewater will not discharge directly into state surface waters under prescribed rainfall conditions, and for protection of ground water quality.

An owner who applies for a VPA permit is also required to provide conceptual plans for the pollution abatement facility. The application and plans are then reviewed and a site inspection is made. Whenever pits, ponds, or lagoons, and/or land treatment is proposed as part of the pollution abatement facility, it is determined if a potential threat to ground water quality exists. If so, the owner must supply site evaluation data and, possibly, a ground water monitoring program prior to receiving approval for a VPA permit.

The Virginia Pollution Abatement Permit Regulation (VR 680-14-01) was adopted on July 1, 1988. Prior to this regulation, the DEQ issued No-Discharge Certificates pursuant to Procedural Rule No. 2. With the adoption of the VPA permit regulation, Procedural Rule No. 2 was suspended and ultimately canceled. No-Discharge Certificates remain in effect until the owner is notified by the DEQ that an application for a VPA permit is required. Concurrent with the issuance of a permit, the No-Discharge Certificate is revoked subject to appropriate notice and opportunity for a hearing. To date, a total of 260 VPA permits have been issued. Due to the changes under the VPA regulation, it is estimated that 50 percent of the old certificates will be revoked without VPA permit issuance. Other industrial operations for which VPA permits are issued include timber products, textile, meat packing and rendering, food processing, chemical products, metal plating, petroleum products distribution, car washes, laundromats, mining, and others.

Land application is a major no-discharge alternative to conventional discharging systems. In addition to eliminating a direct discharge of pollutants to state waters, an added benefit is derived from the fact that, for waste generators, land treatment is frequently a cost-effective alternative. Landowners receive the benefits of economic incentives in the form of fertilizer savings and soil conditioner value.

In Virginia, the agricultural use of sewage sludge has become so popular with municipalities and farmers that approximately 50 percent of all sewage sludge generated in the State is returned to the land for agricultural use. Not only is this a cost-effective alternative to disposal for municipalities, but the current commercial fertilizer value to farmers is estimated to be over \$2 million annually. Sludge contractors apply sludge on approximately 15,000 acres annually and maintain an inventory of about 50,000 acres of approved sites. As more stringent pollution abatement technologies are

initiated to clean up the Chesapeake Bay, the amount of sludge handled is expected to increase significantly, requiring the technically and economically acceptable disposal option that land application affords. Land application of sewage effluent is also proving to be a sound alternative for treatment of other wastes, such as landfill leachates and industrial waste treatment sludges.

The increasing use of land treatment by industry and municipalities is an encouraging trend. It reflects a growing acceptance on the part of waste generators and regulators alike that it is not only a cost-effective alternative, but one which is a technically sound means of waste or wastewater utilization. As commercial fertilizer costs continue to increase and wastewater treatment requirements become more stringent, land application looks to be a favorable alternative for waste management for both the waste generator and land owner.

Water Quality Planning

DEQ uses Water Quality Management Plans (WQMPs), required by section 303(e) of the Clean Water Act, as the link between the water quality assessment required for this report and water quality based controls. These plans recommend control measures for the water quality problems identified and characterized in the 305(b) report. Control measures recommended in the plans are implemented through the VPDES permit system for point sources and through the application of Best Management Practices (BMPs) for nonpoint sources. WQMPs establish the strategy for returning impaired waters to meet water quality standards and for preventing the degradation of high quality waters.

Waterbodies are classified as effluent limited (E. L.) where water is known to meet state water quality standards after the application of technology-based effluent limits or other required controls. Waterbodies not meeting existing water quality standards after the application of technology-based effluent limits or controls are classified as water quality limited (W.Q.L.).

The DEQ uses the WQMPs to implement the total maximum daily load (TMDL) process required by Section 303(d) of the Clean Water Act. TMDLs are the allowable loadings or loading strategies for waterbodies classified as water quality limited. The TMDL process is a mechanism for integrating the point and nonpoint source loads contributing to the impairment of the waterbody. Only by controlling both sources of pollutants, can water quality be restored to the affected waterbodies.

Pollution Response Program

Pollution Response Program (PReP) was established to provide state response to pollution incidents which affect waters of the Commonwealth.

Regional offices maintain 24 hour PReP phone service to receive citizen pollution reports. After hours, weekends, and on holidays, these calls are received by the Emergency Operations Center (VAEOC) operated by the Department of Emergency Services. VAEOC forwards the information via electronic mail to the regional office PReP Coordinators and to the VDH. Regional investigators are prepared to investigate events that have the potential to cause adverse environmental effects on a 24-hour basis. Trained personnel are on call to investigate and assist when needed with coordinating remediation activities associated with oil pollution incidents, fish kills, underground storage tank (UST) incidents and a variety of other reported incidents.

Chapter 2.3

COST/BENEFIT ANALYSIS

Construction Grants.

The Federal construction grants program was initiated in 1958 to provide financial assistance to municipalities for the planning, design, and construction of publicly owned treatment works. Since then, the program has been an essential element in pollution control efforts, without which many localities would have been unable to provide wastewater treatment systems.

Through 1988, Virginia received approximately \$1.2 billion in federal appropriations for construction grants. These federal funds financed up to 75% of the total eligible cost of approximately 183 projects. The state contributed another \$52.3 million toward project costs, with the remainder coming from local sources. Total local investment in these projects is estimated at \$500 million.

Virginia Revolving Loan Fund.

In 1988, the conversion from a "grant" program to a "low-interest loan" program to provide financial assistance for the planning, design and construction of POTW's began. Prior to this conversion, the 1986 General Assembly created the Virginia Water Facilities Loan Fund, through which grant related loans could be made to local governments at or below current market interest rates for wastewater treatment improvements. Principal and interest repaid into the fund could then be reloaned again for additional projects. The Federal Water Quality Act of 1987 established a State Revolving Loan Fund Capitalization Grant Program which provided an legal avenue for states to convert federal grant monies into a State Revolving Loan Fund.

On June 10, 1988, Virginia became the first state in EPA Region III and the fifth state in the nation to receive authorization to administer a State Revolving Loan Program. Since then, Virginia has received federal capitalization grants in each fiscal year (FY's 88 through 97) totaling \$358,140,169. In addition, Virginia has provided \$71,628,035 to the program.

Federal law allows grant funds recovered through audit and grant closeouts to be reallocated and converted to revolving loan monies. Virginia has been aggressive in pursuing administrative closeout of previous EPA grant projects, and since 1987, has recovered more than \$30 million through this process. Table 2.3 - 1 summarizes Revolving Loan Fund status as of June 30, 1997.

Table 2.3 - 1 - Summary of Revolving Loan Fund Status

STATUS	NUMBER	AMOUNT
Loans Closed During Assessment Period	110	\$ 461,102,374.81
Loans Committed	18	\$ 69,190,528.00
Targeted For FY 1998	21	\$ 71,302,951.00
Total	149	\$ 601,595,853.81

The impact of Virginia's loan program on water quality and public health can be summarized as follows:

- Eliminated 12 primary dischargers

- Upgraded or replaced 25 inadequate lagoons
- Upgraded, expanded, or replaced 80 outdated treatment facilities
- Improved water quality at 38 locations by significantly reducing infiltration and inflow
- Corrected 21 potential health hazard situations through the elimination of failing septic systems, pit privies, and straight-line discharges
- Eliminated 96 raw sewage overflow points

In 1996, the General Assembly amended the Code of Virginia to provide financial assistance from the revolving loan fund to address malfunctioning or inadequate on-site wastewater disposal systems where public health or water quality concerns exist and where connection to a public sewer system is not feasible. As a result of the Code change, the On-site Wastewater Treatment Program was created.

DEQ, VRA and the Department of Health worked together to jointly develop implementation guidelines for this pilot program to make low-interest loans available to local governments. Localities could then lend the money to individual property owners or small business to repair or install septic systems, sand filters, mound systems or other innovative, alternative sewage treatment systems.

The On-Site Wastewater Treatment Program funding initiative will operate as a pilot program during fiscal years 1997 and 1998. During this pilot program effort, DEQ and VRA will work with the local governments and their citizens to develop and implement local funding plans. The pilot concept allows the greatest flexibility for considering new ideas especially in the development of the funding plans.

In FY 97, Congress appropriated \$50 million for the Rural Communities Hardship Grant Program. Virginia's share of this appropriation was \$1,376,300 to be used in conjunction with the revolving loan program as "hardship grants" for rural communities.

604(b), 104(b)(3), and Clean Lakes Grant Programs

Federal funds have been used for Water Quality Management Planning and Implementation projects. The funds have been split between the Planning District Commissions for watershed planning and educational activities, and Internal Special Projects and equipment acquisitions to facilitate water quality monitoring and assessment activities. Table 2.3 - 2 summarizes 604(b), 104(b)(3), and Clean Lakes grant activities for the period June 1992 through June of 1997.

Table 2.3 - 2 Summary of Water Quality Management Grants

YEAR	604(B)	104(B)(3)	CLEAN LAKES	YR TOTAL
1992-1993	\$401,657	NA	\$104,491	\$506,148
1993-1994	\$397,328	NA	NA	\$397,328
1994-1995	\$246,537	\$149,040	\$56,250	\$451,827
1995-1996	\$254,620	\$182,160	\$28,000	\$464,780
1996-1997	\$417,075	\$161,807	-0-	\$578,882

YEAR	604(B)	104(B)(3)	CLEAN LAKES	YR TOTAL
TOTALS	\$1,717,217	\$493,007	\$188,741	\$2,398,965

Nonpoint Source Expenditures

Expenditures for non-point source related program activities have totaled approximately \$54.77 million over the last ten years. Of this amount, \$7.94 million was expended during the last two fiscal years. These figures represent actual expenditures by the Department of Conservation and Recreation and do not include expenditures for non-point source programs of other state agencies. Estimates of expenditures prior to 1985 are not available.

Chapter 2.4 POLLUTION PREVENTION (P2)

Recognized as the most cost-effective form of environmental protection, pollution prevention (or P2) is an environmental management strategy that emphasizes the elimination or reduction of wastes at the source of generation. Traditional waste management techniques, such as treatment and disposal concentrate on managing wastes after they are generated. Treatment, handling, and disposal of wastes result in significant financial costs and involve regulatory and compliance issues. In addition, traditional treatment processes of one waste stream often result in transferring contaminants to another that also must be managed (such as treating an air emission with a scrubbing operation which results in a wastewater stream).

Through P2 techniques, companies can eliminate or significantly decrease the quantity and/or toxicity of their generated wastes. Companies can avoid the direct costs and long-term liabilities associated with producing and managing those wastes. Source reduction techniques often result in increased production efficiencies which can decrease raw material purchasing needs. Also, P2 techniques emphasize a multi-media approach which avoids transferring contamination from one media to another.

Wastes are essentially wasted raw materials, and P2 efforts strive to conserve the use of raw materials by using them as efficiently as possible. P2 or source reduction is distinguished from recycling and reuse efforts, because these management techniques involve waste handling, collection, and reprocessing into a new raw material or useable product. True source reduction eliminates the need and the costs associated with wastes handling.

Goals of P2

- Eliminate or reduce waste generation
- Reduce the toxicity of generated wastes
- Conserve natural resources and materials
- Prevent spills and accidental releases
- Prevent raw materials and product losses

P2 techniques are proactive approaches and solutions to waste management issues and problems. Categories include process efficiency improvements, materials substitution, inventory control, preventive maintenance, improved housekeeping, in-process recycling, and office waste reduction. These techniques may involve complex capital upgrades for new equipment and computerized automation of monitoring equipment. However, many P2 techniques are as simple as using less-toxic raw materials or changing certain facility procedures.

Categories of P2 Techniques

<u>Categories</u>	<u>Description</u>
Process Efficiency Improvements	Changes in process and/or equipment to produce less waste and use raw materials more efficiently.
Materials Substitution	Replacing hazardous chemicals with less toxic alternatives of equal performance.
Inventory Control	Reducing product losses due to product expiration and overstocking; "first-in, first-out" and "on-time" inventory control will reduce wastes and losses due to expiration and decomposition of containers.

Preventive Maintenance	Any activities that prevent equipment failures and environmental releases such as spills, leaks, or air emissions.
Improved Housekeeping	Keeping a clean shop helps conserve resources by preventing product losses due to spills and accidents.
In-Process Recycling	When materials are redirected back into the production process.
Office Waste Reduction	Computer automation, use of 2-sided copies, and re-use of scrap paper reduces waste generation; use of energy efficient equipment reduces overall need for electricity generation which causes pollution.

Companies who utilize P2 approaches to waste management can realize the full costs associated with wasting by performing a waste assessment audit. Normal accounting procedures consider only the costs associated with disposal and possibly treatment. A waste assessment audit also considers the cost of raw materials wasted, the time associated with handling and environmental compliance, and long-term liability and coordination requirements. Once companies consider all of the costs associated with wasting, the financial benefits of pollution prevention projects often becomes clear.

- Reduced costs of:
 - ⇒Waste treatment and disposal
 - ⇒Raw materials purchases
 - ⇒Process operations
- Meeting or exceeding environmental requirements
- Reduce potential environmental liabilities
- Protect employee health and safety
- Protect the environment

Most major industries with environmental staffs are aware of and have implemented pollution prevention techniques. These companies are realizing the benefits of P2 techniques to help their bottom line and gain a competitive advantage over other companies in their market. Many companies have been able to decrease their generation of hazardous and other wastes to such an extent that they can avoid environmental regulations and requirements altogether, resulting in significantly decreased long-term liabilities and expenditures. Many companies, however, do not have trained environmental staff persons who are able to investigate P2 opportunities and industrial advancements.

DEQ's Office of Pollution Prevention

DEQ's Office of Pollution Prevention (OPP) is the state's central authority for pollution prevention techniques and is available to assist companies throughout the state. DEQ's OPP maintains a clearinghouse of resources and guidance materials specific to all industrial sectors and most business activities and OPP staff is available to provide technical consultation and on-site assistance to business, industry, and government entities. OPP staff can also help develop educational materials and provide employee training at a given facility, and OPP consultation and assistance is non-regulatory and confidential. DEQ's OPP promotes P2 activities statewide by providing technical assistance activities, through outreach efforts, and various other initiatives.

Technical Assistance

OPP staff provides technical assistance to business, industry, government, and citizens. OPP maintains an information library containing manuals, articles, videos, and other resources on the most

up-to-date P2 techniques and innovative products and approaches. In addition, the Internet provides access to an abundance of P2 information from other states and the federal government. OPP staff will research waste issues and problems and provide requestors with the information they need in a timely fashion.

OPP staff is also trained in performing on-site P2 opportunity assessments. These site visits are non-regulatory and confidential and can help companies identify potential solutions to their waste management problems. During site visits, OPP staff will tour the facility asking questions about production, the flow of raw materials, and other waste management issues in order to identify potential P2 opportunities. After an assessment, OPP staff researches issues further and provides suggestions for reducing wastes. Companies are under no requirements to implement OPP suggestions, and some suggestions may require additional consideration and research by the company. Because the visits are strictly voluntary, the majority of OPP's suggestions are intended to save the company money while protecting the environment.

Outreach

DEQ's OPP conducts outreach activities to promote the use of P2 as the preferred solution to waste management problems. Outreach consists of training, presentations, publications, and the Internet homepage.

Teaching employees to consider and value P2 is one of the most effective ways of implementing a P2 program and continuing to find P2 solutions. Therefore, OPP is available to help companies provide P2 training and/or design on-site employee training programs. OPP also sponsors training workshops and conferences and makes presentations whenever requested to provide both general and technical information to various other audiences.

OPP publishes various fact sheets, videos, and reports to provide guidance on issues that are relevant to Virginia businesses, government, and citizens. In addition, OPP publishes a quarterly newsletter entitled *Pollution Prevention Virginia*, which highlights companies who have successfully implemented P2, P2 products, and on-going projects by OPP and related programs. OPP also maintains an Internet webpage which provides access to many of its clearinghouse resources, links to other P2 Internet information sources, and direct e-mail to OPP staff.

P2 Initiatives/Partnerships

Initiatives

In support of its outreach activities and general promotion of P2, OPP is involved in various special projects and initiatives. A few of these include state agency P2 planning, regulatory integration, and Businesses for the Bay.

State agency P2 planning is a result of the General Assembly's House Joint Resolution 453 (1995) requesting state agencies to consider and implement P2 when practical. DEQ has coordinated a 3-year schedule of training and development and implementation of P2 plans for affected state agencies. Many agencies have made great strides in reducing their generation of waste streams while realizing cost savings.

Regulatory integration is the process by which OPP has attempted to incorporate P2 principles and training throughout DEQ's regulatory functions. By training permit writers, inspectors, and enforcement staff to identify potential P2 opportunities, DEQ regulatory staff can often encourage companies to make proactive changes which will keep them in compliance and save them money. At the least, regulatory staff should be able to make companies aware of opportunities for assistance through OPP or other assistance groups. As part of this education, OPP staff performs joint P2

assessment/compliance inspections to teach regulatory staff how to identify P2 opportunities. In addition, P2 projects are increasingly being used by enforcement personnel in the form of Supplemental Environmental Projects (SEPs) in lieu of certain fines and penalties.

Businesses for the Bay is a voluntary P2 initiative that is centrally coordinated by the EPA's Chesapeake Bay Program. Virginia's OPP and the state P2 offices from Maryland and Pennsylvania are promoting Businesses for the Bay as a program to encourage the reduced use of toxic chemicals and the generation of wastes. Program members annually make voluntary P2 commitments and report on their successes. The program also has created a business-to-business mentoring program to assist smaller companies in learning about P2 opportunities. Members receive periodic public recognition for their efforts and are eligible for various awards. To date, 94 Virginia businesses and government facilities have committed to the program.

Partnerships

DEQ's OPP strives to maximize its own efficiency in promoting P2 activities by leveraging itself through various partnerships with other technical service providers. OPP works in partnership with groups such as the National Pollution Prevention Roundtable, the Elizabeth River Project, the Virginia Philpott Manufacturing Extension Partnership, and the Center for Innovative Technology (CIT) to fund and sponsor events such as regional conferences, workshops, and a P2 grants program. In addition, OPP is networked with technical assistance groups such as the Small Business Development Centers, DEQ's Office of Small Business Assistance, and university programs across the state.

P2 and Water Quality

In the case of water pollution, DEQ's OPP works with municipal pre-treatment programs and directly with business and industry to encourage the voluntary use of waste reducing techniques as a means to minimize the quantity and toxicity of wastewater discharges and to facilitate regulatory compliance. Instead of constructing treatment facilities and paying wastewater disposal fees, industrial facilities can implement source reduction measures which can eliminate or significantly decrease their wastewater discharges. DEQ's OPP works with DEQ regional pre-treatment inspectors to encourage such measures as potential solutions to permit compliance difficulties, offering mutual benefits to municipalities, businesses, and water quality.

Many facilities have successfully reduced discharge fees or avoided the construction of treatment facilities and individual discharge permits by implementing in-process water recycling systems. Facilities benefit from significantly decreased costs for water usage, as well as disposal cost, and some facilities have even achieved "near-zero" discharge through the use of "closed loop" systems. As a general rule, separation of waste streams is the most effective technique for reducing wastewater discharges because it creates opportunities for on-site, in-process recycling. Other effective measures include counter-current rinsing, increased automation to provide increased production efficiency, substitution of less toxic chemicals/materials, installation of leak detection systems, preventive maintenance, and improved inventory control.

DEQ's Office of Pollution Prevention may be contacted at (804) 698-4235 or through the website "www.deq.state.va.us/opp/opp.html".

Chapter 2.5 PUBLIC HEALTH/AQUATIC LIFE CONCERNS

Increasingly, the DEQ is addressing the role toxicants play in reducing water quality in state waters, and supports programs to monitor, evaluate, and reduce toxicity to aquatic life and human health. Many of the programs in place at DEQ that address toxicity in state waters are described and discussed throughout this report.

The toxic pollutants that were monitored during the reporting period include toxic organics, metals and pesticides. Information on the state's monitoring programs and the results of this monitoring for toxics in water column, fish tissue, and sediment is provided in Chapters 3.1 and 3.3 of this report. A discussion of the methodology used to determine elevated levels of toxicants is provided in Chapter 3.2.

At the beginning of the reporting period, the State had in effect numeric surface water quality criteria for the protection of aquatic life for 34 substances, and surface water quality standards for mercury in fresh water, chlorine, and tributyltin. A human health standard for dioxin was adopted in September 1990. Virginia differentiates between standards and criteria, in that standards are always mandatory, while criteria may be modified on a case-by-case basis. In January 1992, the SWCB adopted mandatory surface water quality standards for the protection of aquatic life for 41 substances, and human health standards for 66 substances. These standards will greatly enhance the Department's ability to reduce toxicity in state waters through permitting and enforcement activities.

Numeric surface water quality criteria for the protection of aquatic life have been adopted, as of the end of the current reporting period, for the following 35 toxic substances:

Aldrin	Demeton	Methoxychlor
Ammonia	Dieldrin	Mirex
Arsenic	Endosulfan	Nickel
Cadmium	Endrin	Parathion
Chlordane	Guthion	PCB's
Chloride	Heptachlor	Pentachlorophenol
Chlorine	Hydrogen Sulfide	Selenium
Chlorpyrifos	Kepone	Silver
Chromium	Lead	TBT
Copper	Lindane	Toxaphene
Cyanide	Malathion	Zinc
DDT	Mercury	

Fishing Advisories and Restrictions

The VDH Bureau of Toxic Substances Information has five health advisories and one restriction currently in effect for fish consumption. The fish consumption advisory in the Jackson River and Upper James River due to dioxin, was lifted in 1993. Also, the fish consumption advisory which had been in effect for dioxin in the Blackwater and Nottoway Rivers has just recently been lifted. A fishing restriction allows sport fishing within the affected area, but the taking of fish for human consumption is prohibited. A health advisory warns of potentially dangerous levels of contamination found in fish tissues in an affected area and may suggest limited consumption but does not prohibit consumption. Under health advisories, the population at risk and a safe maximum consumption rate may be specified. These areas are described below. The advisories and restriction affect a total of 278 mainstem river miles.

Kepone in the Lower James River

From 1966 through 1975 Allied Chemical Company and its subsidiary Life Science Products, Inc. produced a persistent chlorinated hydrocarbon insecticide called Kepone. During production, an

estimated 90,720 kg of Kepone was released to the environment through atmospheric emissions, wastewater discharges, and bulk-disposal of off-specification batches. The James River and its tributaries from Richmond to Newport News were contaminated with Kepone. In 1975, the entire James River from the fall line at Richmond to the Hampton Roads/Norfolk Bridge Tunnel, including all tributaries, was closed to the taking of any shellfish and/or finfish because of Kepone. From 1975 through 1988 various Kepone bans were in place. In 1988, all James River fishing restrictions due to Kepone were allowed to expire as Kepone levels in fish remained below the U.S. Food and Drug Administration (FDA) action level of 0.30 ppm. This area is currently under a contaminant advisory, covering the mainstem James River and all tributaries from the fall line at Richmond to the Hampton Roads-Norfolk Bridge Tunnel.

DEQ has continually monitored Kepone levels in the James River since its identification in 1975. The major areas of concern were Kepone levels in the water column, finfish, and sediment of the James River and its tributaries, and in the ground water in Hopewell. After continuous non-detectable results, water column monitoring was discontinued in 1981. Kepone levels in finfish, ground water, and sediment have decreased since the onset of the problem. Continued monitoring will provide the state with an up-to-date portrayal of Kepone levels throughout the contaminated reach of the river. The waterbodies affected by this health advisory are: VAT-G11, VAT-G10, VAP-G08, VAP-G07, VAP-G04, VAP-G03, VAP-G02, VAP-G01, and VAP-J15.

Mercury in the North Fork Holston River

Eighty miles of the North Fork Holston River in southwestern Virginia were contaminated with mercury by releases from the Olin manufacturing operation in Saltville. Although the chemical plant closed in 1972, mercury levels in fish remain above FDA action levels, and the consumption of fish from this area is prohibited. Catch-and-release fishing is allowed. This health restriction includes waterbodies VAS-013, VAS-012, VAS-011, and VAS-010.

Mercury in the South River and the South Fork Shenandoah River

Mercury was released by E. I. DuPont de Nemours and Company, a synthetic fibers plant in Waynesboro, into the South River and South Fork Shenandoah River from 1929 to 1950. The contamination was discovered in 1977, and was found to have contaminated 103 river miles, from the plant to the Page/Warren county line. These areas remain under a health advisory for fish consumption due to mercury contamination. The VDH recommends that no more than one meal (½ pound) per week of fish from these waters be consumed. Small children and pregnant women are advised not to consume any fish containing mercury. This health advisory is located in all or a portion of waterbodies, VAV-B40, VAV-B38, VAV-B37, VAV-B35, VAV-B33, and VAV-B32.

PCBs in the South Fork Shenandoah River, North Fork Shenandoah River, and Shenandoah River

The VDH has issued a public health advisory warning against the consumption of fish taken from the South Fork Shenandoah River from the State Route 619 bridge downstream to the Shenandoah River headwaters; from the North Fork Shenandoah River at its confluence with Passage Creek downstream to the Shenandoah River; and from the Shenandoah River from the confluence of the North and South Fork Shenandoah Rivers to the Virginia/West Virginia state border. This covers approximately 45 stream miles. This advisory was issued after DEQ monitoring revealed PCB levels in fish tissue samples above the 2.0 ppm FDA action level. The source of this contamination has been identified as Avtex Fibers Front Royal Inc. This plant closed in 1989 following revocation of their VPDES permit. This health advisory is located in waterbodies VAV-B58, VAV-B57, VAV-B55, VAV-B51, VAV-B41.

PCB in the Roanoke River

A health advisory for fish consumption has been issued for a 50 mile stretch of the Roanoke

River running through Cambell, Charlotte, Halifax and Pittsylvania counties. Polychlorinated biphenyls, commonly known as PCBs, have been detected in fish tissues of striped bass, white bass and carp. The advisory has been issued from Seneca Creek at Route 704 near Long Island downstream to the point where a pipeline intersects Route 803 and where Route 633 in Charlotte county crosses the Roanoke River (approximately 5.4 river miles below the route 360 bridge). People should eat no more than two eight-ounce meals a month of these fish species. These meal estimates are based on the possibility that eating PCB-contaminated fish may increase the risk of cancer in humans. The source of the contamination is unknown. Affected waterbodies are VAW-L30, VAW-L31, VAP-L36, VAP-L38, VAP-L40, VAP-L75 and VAP-L80

Tributyltin

Surface water samples were collected and analyzed by the Applied Marine Research Laboratory at Old Dominion University for the determination of the concentration of tributyltin (TBT) at one station in the Hampton Roads Harbor area and eleven stations in the Elizabeth River area of the lower James River. The samples were collected during six monitoring events over the period of June 1993 to March 1995. In-stream concentrations were compared to the Virginia Water Quality Standard for TBT in saltwater surface waters (VR680-21-01.13) which are not at any time to exceed 0.001 parts per billion (ug/l) TBT. The station in the Hampton Roads Harbor area did not exceed the standard. Six of the eleven stations in the Elizabeth River area exceeded the standard for TBT. The distribution of stations exceeding the TBT standard are as follows: three stations in the Elizabeth River main stem, one station in the Eastern Branch Elizabeth River, and two stations in the Southern Branch Elizabeth River. The exceedances occurred in segments which support considerable commercial vessel traffic with TBT hull coatings.

Shellfish Condemnations

The Virginia Department of Health has prohibited and/or condemned harvest of approximately 140 square miles of productive shellfish areas in the waters of Virginia. Another 6 square miles square miles have been seasonally condemned, which restricts direct harvesting from 1 April to 31 October of each year. These areas are all located in the Chesapeake Bay and Tidewater areas of the state, and include waters surrounding certain point source discharges, as well as areas with elevated fecal coliform bacteria concentrations or other problems. Shellfish may be harvested from most restricted areas; however, they must first be relayed to approved waters for depuration for 15 days before marketing. Relaying is only allowed when the water temperature is above 50°F. The taking of shellfish is prohibited in three bodies of water: the Elizabeth and Lafayette Rivers, both within the lower James River subbasins; and Little Creek in the Small Coastal and Chesapeake Bay Basin.

Fish Tissue Contamination

The fish tissue monitoring program collects and analyzes fillet and whole body fish samples from stations located throughout the state. The objective of this program is to systematically assess and evaluate water bodies of the Commonwealth to identify areas where toxic contaminant accumulation has the potential of adversely affecting human health or the biological community.

The data generated by this program are evaluated utilizing EPA risk based screening values which incorporate the following assumptions: (1) general population adults; (2) body weight 70 kg; (3) risk level 10^{-5} ; and (4) consumption rate 0.0065 kg/day. The methodology and equations follow the EPA Guidance For Assessing Chemical Contaminant Data For Use In Fish Advisories (1994).

At the majority of stations, the levels of lead detected in fish tissue met or exceeded the EPA calculated human health risk based screening values for fish tissue. Based on the data and historical information, it has been recommended that further investigation is warranted to document the extent of this contamination.

At three stations (Pamunkey River, Mattaponi River, and lower James River), PCBs were detected at levels which exceeded the EPA calculated human health risk based screening value. These stations are being reviewed for further evaluation.

Chlordane was detected at levels exceeding the EPA calculated human health risk based screening value in striped bass from the lower James River. This station has also been recommended for further evaluation.

Mercury was detected, equaling the EPA calculated human health risk based screening value, in striped bass from the Mattaponi River station. Further sampling and evaluation is planned for the upcoming assessment period.

The Fish Tissue Monitoring Program reports have been forwarded to the Virginia Department of Health and the Virginia Department of Game and Inland Fisheries for their analysis, comment and management action. Additional information on fish tissue monitoring can be found in Chapter 3.1.

Fish Kills/Abnormalities

DEQ regional offices responded to several fish kill incidents affecting State waters during the summer of 1997. These incidents appeared to be related to a potentially toxic microorganism *Pfiesteria piscicida* which was originally identified in North Carolina. A great deal of effort on the part of several state agencies and universities has been put into trying to confirm the existence of this microorganism in Virginia's waters. Similar effort has been put into trying to understand the life cycle and the mechanism involved in the massive fish kills associated with this organism.

In August 1997, approximately 10,000 fish were found dead in Maryland's Pocomoke River and fish with body lesions were also reported. Maryland officials closed the upper Pocomoke River because it is believed that direct contact with water during a *Pfiesteria piscicida* outbreak can cause human health problems. Later in the month 2,000 dead fish (menhaden) were found in the Virginia portion of the river and it was also closed for several weeks.

Pfiesteria piscicida, a dinoflagellate, has a very complex life cycle which includes 24 distinct life forms. It can thrive as an active, free-swimming animal, an amoeba-like form or as a dormant, sediment dwelling cyst. Researchers have found 10 different *Pfiesteria*-like species that closely resemble each other. They are extremely difficult to distinguish from each other without the aid of an electron microscope. Scientists have grouped these similar species into a category known as Pfiesteria complex organism (PCO). It includes two *Pfiesteria* species (*piscicida* and one unnamed species) and several species not of the genera *Pfiesteria*. Three of these PCO's are known to be capable of producing toxicity toward fish. A *Pfiesteria*-like organism was found in samples taken from the Rappahannock and Great Wicomico rivers but it has not yet been determined which PCO they are.

Under certain environmental conditions that are not yet fully understood, and only in the presence of live fish, lab experiments have shown that *Pfiesteria piscicida* do release toxins. Researchers propose that upon stimulation from the appropriate cues (fish excretions, nutrient conditions, lack of mixing, salinity, etc.), *Pfiesteria piscicida* cysts are activated, emerge from sediments as free-swimming forms and release toxins. The toxins attack the nervous system which make the fish lethargic causing them to remain in the area where additional toxin damage can occur. The toxins also cause sloughing of the skin and subsequent lesions.

The free-swimming form of *Pfiesteria* feed on the blood and tissue from the open sores, and eventually the fish die. The lesions and fish kills in Maryland's upper Pocomoke River have been linked to *Pfiesteria piscicida*. Samples from Virginia waters sent to laboratories in North Carolina and Florida for analysis and culture thus far have proved negative.

Virginia scientists were vigilant last summer as reports of fish with lesions came in from fisherman. While lesions can be an indicator of a *Pfiesteria* outbreak, they can develop on fish for

many possible reasons. Physical injury from nets or traps, bites by other fish or birds, toxic chemicals, and infectious disease agents such as viruses, bacteria and fungi can all cause lesions. When the skin or mucus barrier of a fish is broken, the area is usually colonized rapidly by bacteria and fungi which further erode the tissue. Assessing the original cause of a lesion is extremely difficult unless an obvious parasite is present.

Actions DEQ and other Virginia agencies have taken

The Virginia *Pfiesteria* Task Force was formed in June 1997 to provide scientific guidance and a reasoned approach to the threat. Members include the Virginia Marine Resources Commission (VMRC), Virginia Department of Health (VDH), the Virginia Department of Environmental Quality (DEQ), and researchers from the Virginia Institute of Marine Sciences (VIMS) and Old Dominion University (ODU). When the fish kill occurred on August 26th in the Virginia portion of the Pocomoke River, the state responded quickly in a coordinated and comprehensive fashion with the following actions:

- \$800,000 was pledged by the Governor to investigate the issue and Virginia has entered into a cooperative agreement with governors from five other mid-Atlantic states to combat *Pfiesteria* regionally.
- DEQ collected samples of water, sediments and fish for analysis by leading authorities from ODU and VIMS, as well as NC State University and the Florida Marine Research Institute, leading authorities on the organism.
- DEQ contracted ODU to examine the presence of *Pfiesteria* in sediments of the lower Chesapeake Bay, James River, York River, and Rappahannock River.
- Task Force members researched the nature and distribution of fish lesions to determine the presence of *Pfiesteria* and other potentially toxic microorganisms in the Virginia portion of the Bay.
- Scientists continued to monitor the Pocomoke River and the Rappahannock River after receiving reports of lesioned fish.
- The Virginia Department of Health asked all Eastern Shore physicians to report any related illnesses.

Relationship between *Pfiesteria* and water quality

Popular press reports have linked *Pfiesteria piscicida* with nutrient enriched waters and suggest manure from animal rearing and processing operations as a source of the nutrient enrichment. This possible connection is still largely unknown because of the complexity of the life cycle associated with the organism. *Pfiesteria piscicida* and *Pfiesteria-like species* are normally nontoxic animals that eat bacteria, algae, and dissolved organic nutrients. It appears they only become toxic when they detect substances excreted/secreted by large concentrations of live fish and other possible environmental stimuli. Researchers hypothesize that the optimal conditions for a fish kill is a poorly flushed estuarine area protected from strong winds and wave action which would mix the water and dilute both fish excreta and the toxins released by the microbe.

Since *Pfiesteria piscicida* is an animal and not a plant, it seems less likely to respond directly to nutrient enrichment. Its preferred food is algae and one might expect *Pfiesteria* to be present where algae is abundant. Excess nitrogen and phosphorus stimulate algae blooms therefore, it could be indirectly linked to nutrient enrichment through its preferred food supply. For this reason, researchers speculate that poorly flushed areas with high nutrient levels might be more susceptible to outbreaks.

In general, the Chesapeake Bay and its tributaries are not considered, by many, as nutrient enriched as the Pamlico Sound and other estuarine tributaries in North Carolina where *Pfiesteria piscicida* is known to have caused large fish kills (10^3 and 10^9). There is little documented research on the topic and only a few scientific experiments conducted which indicate nutrient enrichment as a possible stimulus to *Pfiesteria piscicida*. Dr. Eugene Bureson, director for research and advisory services at the Virginia Institute of Marine Science (VIMS) suggests that hydrodynamic conditions may explain why low populations of *Pfiesteria* can exist without causing fish kills or human health problems. Until more research results are available, it is not possible to say with confidence why *Pfiesteria piscicida* outbreaks occur where they do and why they become toxic when and where they do. Additional research is planned for the summer of 1998 and DEQ will be directly involved in collecting samples during any associated fish kills in Virginia waters.

Reporting fish kills or fish with lesions

DEQ has responsibility for investigating fish kills and reports of fish with lesions in Virginia waters. Call 1 (800) 592-54VA to be directed to the appropriate regional office. Once reported, DEQ collects water samples for oxygen and other chemical parameters along with actual fish samples. Water samples are sent to ODU for analysis and fish samples are sent to VIMS. For any health related concerns, call the VDH hotline at 1 (888) 238-6154.

For additional information:

www.vims.edu/welcome/news/pfiesteria
www2.ncsu.edu/unity/lockers/project/aquatic_botany/pfiest.html
www.gateway-va.com/pages/fish/1030fish.htm
www.gacc.com/dnr
[www.mdsg.umd.edu/fish-health\(pfiesteria\)](http://www.mdsg.umd.edu/fish-health(pfiesteria))

Potomac and Shenandoah River Basin

The Potomac-Shenandoah River Basin, as its name implies, is made up of the Shenandoah River Subbasin and the Potomac River Subbasin. It occupies the northern portion of Virginia and covers 5,747 square miles or 14 percent of the Commonwealth's total area.

In Virginia, the Potomac-Shenandoah basin is defined by both hydrologic and political boundaries. The basin is bounded by the James River, Rappahannock River, and York River Basins to the west and south. The northern and eastern perimeter of the basin is bounded by the West Virginia and Maryland State lines and the District of Columbia.

The Shenandoah River Subbasin headwaters begin in Augusta County and flow in a northeasterly direction for approximately 100 miles to the West Virginia State line. The basin averages 30 miles in width and covers 2,926 square miles.

The topography of the Shenandoah River Subbasin is characterized by rolling hills and valleys bordered by the Appalachian Mountains to the west and the Blue Ridge Mountains to the east. The Massanutten Mountain Range divides the Shenandoah River into the North and South Forks. Tributaries of the Shenandoah River exhibit steep profiles as they drain the surrounding mountain ridge. The main stems of the Shenandoah exhibit a moderately sloping profile with occasional riffles and pools. 45 percent of the land is forested due to the large amount of federally owned land and the steep topography. Farmland and pasture account for 39 percent of the land area, while 16 percent is urban.

The Potomac River Subbasin headwaters begin in Highland County. The drainage area is 323 square miles for the headwaters. The river then flows in a northeasterly direction through West Virginia and Maryland before joining the Shenandoah at Harper's Ferry, West Virginia. The Potomac continues as the border between Maryland and Virginia, flowing in a southeasterly direction to the Chesapeake Bay 200 miles away. The Potomac River Subbasin ranges in width from 40 miles at its northern locations in Loudoun and Fauquier Counties to less than one mile in Westmoreland County. Approximately 2,821 of the 14,700 square miles of the Potomac River Subbasin drainage area lie in Virginia. The rest covers four states and the District of Columbia.

The topography of the upper Piedmont region of the Potomac River Subbasin is characterized by gently sloping hills and valleys from Harpers Ferry to about 45 miles down river. In the central Piedmont area, the profile is rather flat until it nears the fall line at Great Falls, where the stream elevation rapidly descends from over 200 feet, to sea level. Tributaries in the central Piedmont exhibit moderate and near constant profiles. Streams in the Coastal Plain area are largely characterized by their flat slope. Approximately 40 percent of the Potomac River Basin is forested, 33 percent is farmland and pasture, and an estimated 27 percent is urban.

The 1994 population for the Potomac-Shenandoah River Basin was approximately 1,973,736. The majority of the population resides in urban Virginia surrounding Washington, D.C. All or part of the following jurisdictions lie within the basin: counties - Augusta, Clarke, Frederick, Page, Rockingham, Shenandoah, Stafford, Warren, Highland, Arlington, Fairfax, Loudoun, Prince William, King George, Northumberland, and Westmoreland; cities - Alexandria, Fairfax, Falls Church, Harrisonburg, Staunton, Waynesboro, and Winchester.

The climate of the basin is temperate with extremes occurring in the western, mountainous portions. Average temperature for the basin is 54°F. The average annual precipitation is approximately 39 inches. Annual snowfall ranges from 10 inches in the coastal plain to 35 inches in the mountains.

The Potomac-Shenandoah River Basin is divided into eight USGS hydrologic units as follows: HUC 02070001-South Branch Potomac; HUC 02070004-Conococheague-Opequon; HUC 02070005-South Fork Shenandoah; HUC 02070006-North Fork Shenandoah; HUC 02070007-Shenandoah; HUC 02070008-Upper Middle Potomac; HUC 02070010-Lower Middle Potomac; and HUC 02070011-Lower Potomac. The eight hydrologic units are further divided into 87 waterbodies or watersheds.

Basin assessment information is included in Tables 2.6-1-1, 2.6-1-2, 2.6-1-3.

TABLE 2.6-1-1

POTOMAC-SHENANDOAH RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Monitored:

Rivers - 2,778.83 miles
 Lakes - 3,951.10 acres
 Estuaries - 58.50 sq. miles

Basin Size

Rivers -5,601miles
 Lakes - 4,137acres
 Estuaries -62 sq. miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	1320.39	1,370.74	298.80	21.80	3011.73
	Lake	4.045.70	91.00	0	0	95.045
	Estuary	20.07	27.20	0	0	47.27
Fish Consumption	River	5,471.94	0	129.49	0	5601.43
	Lake	4,136.70	0	0	0	4136.7
	Estuary	58.59	0	0	0	58.59
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	24.13	0.77	8.46	0	33.36
Swimming	River	655.15	145.25	280.71	183.30	1264.41
	Lake	4,136.70	0	10.08	0.25	4147.03
	Estuary	46.24	0	0.78	0.25	47.27
Drinking Water	River	160.13	0	5.00	0	165.13
	Lake	3,730.40	0	0	0	3730.4
	Estuary	-	-	-	-	0

TABLE 2.6-1-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN POTOMAC-SHENANDOAH BASIN

Cause of Impairment	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthics)	River (mi)	5.07	91.43
	Lakes (acres)	0	0
	Estuary (mi ²)	0	1.21
PCB'S	River (mi)	0	41.78
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	0	103.40
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Siltation	River (mi)	19.82	104.90
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	20.92	104.90
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Thermal Modification	River (mi)	0	24.43
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	167.17	260.90
	Lakes (acres)	0	0
	Estuary (mi ²)	0.25	7.73
Flow Alterations	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Alterations	River (mi)	0	31.48
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	1.50	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 2.6-1-3 SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN POTOMAC SHENANDOAH BASIN

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	1.15	5.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Municipal Point Sources	River (mi)	1.03	13.12
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	141.66	245.22
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	46.09	43.43
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	0	24.43
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Source Unknown	River (mi)	6.25	183.37
	Lakes (acres)	0	0
	Estuary (mi ²)	0.25	0.78
Other Water Quality Standards	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	0	145.18
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Collection System Failure	River (mi)	0	21.12
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Shellfish Condemnation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	8.46

James River Basin

The James River Basin occupies the central portion of Virginia and covers 10,206 square miles or approximately 25 percent of the Commonwealth's total land area. It is Virginia's largest river basin and is made up of the Upper, Middle, and Lower James River Subbasins; and the Appomattox River Subbasin.

The James River Basin is defined by both hydrologic and political boundaries. The basin is bounded by the Potomac-Shenandoah River Basin, the Rappahannock River Basin and the York River Basins to the north. The southern boundary is made up of the New River Basin, the Roanoke River Basin and the Chowan River Basin. Its headwaters originate along the Virginia/West Virginia state line.

The James River Basin begins in the Alleghany Mountains and flows in a southeasterly direction to Hampton Roads where it enters the Chesapeake Bay. The James is formed by the confluence of the Jackson and Cowpasture Rivers and flows 228 miles to the Fall Line at Richmond and another 111 miles to the Chesapeake Bay.

The topography of the James River Basin varies throughout the four physiographic provinces that it spans. The Valley and Ridge Province extends from the Appalachian Plateau in West Virginia to the Blue Ridge Province. This province is dominated by narrow ridges and valleys running in a northeast/southwest direction, turning into a broad valley with low, rounded hills in the extreme southeast section of the province. The Blue Ridge Province, a remnant of a former highland, differs from the Valley and Ridge Province in rock types and geological structure. The Piedmont Province extends from the Blue Ridge Province to the Fall Line. The western section of the Piedmont has scattered hills and small mountains, gradually turning into gently rolling slopes and lower elevation in the eastern Piedmont Province. The Coastal Plain Province is separated from the Piedmont by the Fall Zone. The Fall Zone is a three mile stretch of river running through Richmond where the river descends 84 feet as it flows from the resistant rocks of the Piedmont to the softer sediments of the Coastal Plain.

Over 65 percent of the James River Basin is forested, with 19 percent in cropland and pasture. Approximately 12 percent is considered urban. The 1994 population for the James River Basin was approximately 1,909,511. This population is concentrated in two metropolitan areas: Tidewater, with over one million people, and the Greater Richmond - Petersburg area with over 750,000. Two smaller population centers are the Lynchburg and Charlottesville areas, each with over 100,000 people. All or portions of the following 39 counties and 14 cities lie within the basin: counties - Alleghany, Amherst, Bath, Nelson, Rockbridge, Augusta, Bedford, Botetourt, Campbell, Craig, Giles, Highland, Montgomery, Roanoke, Amelia, Buckingham, Chesterfield, Cumberland, Fluvanna, Goochland, Henrico, Powhatan, Albemarle, Appomattox, Prince Edward, Dinwiddie, Greene, Hanover, Louisa, Nottoway, Orange, Charles City, Isle of Wight, James City, Nansemond, New Kent, Prince George, Surry, and York; cities - Buena Vista, Clifton Forge, Covington, Lexington, Lynchburg, Charlottesville, Colonial Heights, Petersburg, Richmond, Hopewell, Norfolk, Newport News, Suffolk and Williamsburg.

The climate in the James River Basin is classified as humid subtropical but is subject to great variations from the Appalachian Mountains to the Coastal Plain. Lower temperatures and greater snowfall dominate the winter months in the mountainous areas whereas warm air from the Gulf Stream tends to moderate the climate in the Coastal Plain.

Average annual precipitation is 42.5 inches. Average annual snowfall amounts range from over 30 inches in the mountains to less than 10 inches along the coast.

Major tributaries to the James River are Craig Creek, Maury River, Tye River, Rockfish River, Slate River, Rivanna River, Willis Creek, Appomattox River, Chickahominy River, Pagan River, Nansemond River, and the Elizabeth River.

The James River Basin is divided into seven USGS hydrologic units as follows: HUC 02080201 - Upper James, HUC 02080202 - the Maury, HUC 02080203 - Upper Middle James, HUC 02080204 - the Rivanna, HUC 02080205 - Lower Middle James, HUC 02080206 - Lower James, and HUC 02080207 - the Appomattox, and HUC 02080208 - the Elizabeth. The nine hydrologic units are further divided into 92 waterbodies or watersheds.

Basin assessment information is presented in Tables 2.6-2-1, 2.6-2-2, 2.6-2-3.

TABLE 2.6-2-1

JAMES RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Monitored:

Rivers - 3,804.50 miles
 Lakes - 19,312.88 acres
 Estuaries - 228.90 sq. miles

Basin Size

Rivers -12,822 miles
 Lakes - 20,854 acres
 Estuaries -261 sq. Miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	1,209.67	2,905.13	197.66	68.60	4381.06
	Lake	16,237.35	3,346.20	0	0	19583.55
	Estuary	37.75	209.45	13.20	0.50	260.9
Fish Consumption	River	12,740.61	7.95	0	0	12748.56
	Lake	19,583.55	0	0	0	19583.55
	Estuary	23.75	237.15	0	0	260.9
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	100.87	0	50.97	23.75	175.59
Swimming	River	1,299.06	259.87	218.92	30.22	1808.07
	Lake	19,409.55	0	0	0	19409.55
	Estuary	234.15	8.83	13.03	2.42	258.43
Drinking Water	River	236.18	5.00	0	0	241.18
	Lake	14,998.00	0	0	0	14998
	Estuary	-	-	-	-	0

ABLE 2.6-2-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN JAMES BASIN

Cause of Impairment	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthics)	River (mi)	0	49.29
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Unknown Toxicity	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Non-Priority Organics	River (mi)	0	20.20
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pesticides	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics (TBT)	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	13.20
Metals	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	21.63	7.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Siltation	River (mi)	3.16	11.49
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	36.95	65.89
	Lakes (acres)	0	0
	Estuary (mi ²)	0.50	0
Thermal Modification	River (mi)	0	66.81
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	30.22	218.92
	Lakes (acres)	0	0
	Estuary (mi ²)	25.82	64.00
PCB's	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Ammonia	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0.50	0
Suspended Solids	River (mi)	0.20	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 2.6-2-3 SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN JAMES BASIN

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	0.75	18.80
	Lakes (acres)	0	0
	Estuary (mi ²)	0.50	0
Municipal Point Sources	River (mi)	2.16	20.33
	Lakes (acres)	0	0
	Estuary (mi ²)	0.50	0
Combined Sewer Overflow	River (mi)	9.03	33.62
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	8.90	129.11
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	0.84	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	11.74	44.22
	Lakes (acres)	0	0
	Estuary (mi ²)	2.07	9.57
Commercial Port Activity	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	13.20
Habitat Modification	River (mi)	1.00	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Upstream Impoundment	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	34.47	77.96
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.62
Source Unknown	River (mi)	30.22	51.40
	Lakes (acres)	0	0
	Estuary (mi ²)	0.32	2.94
Point/Nonpoint Source	River (mi)	0	26.97
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Shellfish Condemnation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	23.75	50.97

Rappahannock River Basin

The Rappahannock River Basin is located in the northeastern portion of Virginia and covers 2,715 square miles or approximately 6.8 percent of the Commonwealth's total area.

The Rappahannock River Basin is bordered by the Potomac-Shenandoah Basin to the north and the York River Basin and Coastal Basin to the south. The headwaters lie in Fauquier and Rappahannock Counties and flow in a southeasterly direction to its mouth, where it enters the Chesapeake Bay between Lancaster and Middlesex Counties. The Rappahannock River Basin is 184 miles in length and varies in width from 20 to 50 miles.

The Rappahannock River Basin's major tributaries are the Hazel River, Thornton River, Mountain Run, Rapidan River, Robinson River, Cat Point Creek, and the Corotoman River.

The topography of the Rappahannock River Basin changes from steep to flat as it flows from the Blue Ridge Mountains to the Chesapeake Bay. About 51 percent of the basin land is forest, while pasture and cropland make up another 36 percent. Only about 6 percent of the land area is considered urban.

Most of the Rappahannock River Basin lies in the eastern Piedmont and Tidewater areas of the Commonwealth while its headwaters, located on the eastern slopes of the Blue Ridge, are considered to be in the northern and western Piedmont section.

The population for the Rappahannock River Basin was approximately 185,574 in 1994. The basin is mostly rural in character with no large population centers, however, the influence of metropolitan Washington is beginning to be felt in the Fredericksburg and Fauquier areas of the basin. All or portions of the following 18 counties lie within the Basin: Albemarle, Caroline, Culpeper, Essex, Fauquier, Gloucester, Greene, King and Queen, King George, Lancaster, Madison, Middlesex, Orange, Rappahannock, Richmond, Spotsylvania, Stafford and Westmoreland.

The climate of the basin tends to be moderate with an average annual temperature of 55°F in Culpeper, to 58°F in Urbanna. Extremes below zero and above 100°F have been recorded in the basin. Precipitation ranges from an annual average of 36 inches at the headwaters to 46 inches in the lower Tidewater or Coastal Plain but reaches an average of 48 inches at Big Meadows atop the Blue Ridge. Average annual snowfall ranges from 25 inches on the eastern slope of the Blue Ridge to 10 inches at the mouth of the Basin.

The Rappahannock River Basin is divided into two USGS hydrologic units as follows: HUC 02080103 - Rapidan-Upper Rappahannock; and HUC 02080104 - Lower Rappahannock.

Basin assessment information is presented in Tables 2.6-3-1, 2.6-3-2, 2.6-3-3.

TABLE 2.6-3-1

RAPPAHANNOCK RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Monitored:

Rivers - 600.61 miles
 Lakes - 567.50 acres
 Estuaries - 126.72 sq. miles

Basin Size

Rivers - 2,676miles
 Lakes - 651acres
 Estuaries -127 sq. miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	144.42	977.36	9.88	6.92	1138.58
	Lake	650.70	0	0	0	650.7
	Estuary	0	52.48	74.24	0	126.72
Fish Consumption	River	2.676.43	0	0	0	2.676
	Lake	650.70	0	0	0	650.7
	Estuary	125.12	1.60	0	0	126.72
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	105.04	0	11.62	0	116.66
Swimming	River	138.78	52.93	43.50	7.41	242.62
	Lake	650.70	0	0	0	650.7
	Estuary	123.29	0.05	0.06	0	123.4
Drinking Water	River	136.05	0	0	0	136.05
	Lake	488.50	0	0	0	488.5
	Estuary	-	-	-	-	0

TABLE 2.6-3-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN RAPPAHANNOCK BASIN

Cause of Impairment	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthic)	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Unknown Toxicity	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pesticides	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	6.92	2.30
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Siltation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	74.24
Thermal Modification	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	7.41	43.50
	Lakes (acres)	0	0
	Estuary (mi ²)	0	11.68
Habitat Alterations	River (mi)	0	7.58
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 2.6-3-3 SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN RAPPAHANNOCK BASIN

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Municipal Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Combined Sewer Overflow	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Silviculture	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Construction	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Land Disposal	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	74.24
Source Unknown	River (mi)	14.53	45.80
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.06
Point Source/Non Point Source	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Shellfish Condemnation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	11.62

Roanoke River Basin

The Roanoke River Basin covers 6,382 square miles or approximately 16 percent of the Commonwealth's total area. In addition to the Roanoke itself, the basin also contains the Ararat River Subbasin.

The Virginia portion of the Roanoke River Basin is defined by both hydrologic and political boundaries. The basin is bounded to the north by the James River Basin, on the east by the Chowan River Basin, and to the west by the New River Basin. The southern boundary of the basin is the Virginia/North Carolina State line.

The topography of the Roanoke River Basin ranges from steep slopes and valleys in the Valley and Ridge Province to gently sloping terrain east of the mountains in the Piedmont Province.

The Roanoke River Basin headwaters begin in the mountainous terrain of eastern Montgomery County and flow in a southeasterly direction to the Virginia/North Carolina state line. The Roanoke Basin passes through three physiographic provinces, the Valley and Ridge Province to the northwest, and the Blue Ridge and Piedmont Provinces to the southeast.

The Roanoke watershed is large enough to accommodate two major reservoirs, Smith Mountain and Leesville Lakes to the north, and Kerr Reservoir and Lake Gaston located at the junction of the Roanoke River and the North Carolina state line. These reservoirs range in size from the 49,000 acre Kerr Reservoir to the 3,400 acre Leesville Lake. These impoundments are used for both recreation and hydroelectricity.

Major tributaries in the northern section of the basin are the Little Otter and Big Otter Rivers along with the Blackwater and Pigg Rivers. Major tributaries in the southern portion include the Dan River, Smith River, and Banister River.

Over 62 percent of the Roanoke River Basin is forested, while nearly 25 percent is in cropland and pasture. Approximately 10 percent is considered urban.

The 1994 population for the Roanoke River Basin was approximately 669,681. All or portions of the following sixteen counties and six cities lie within the basin: counties - Patrick, Henry, Pittsylvania, Halifax, Franklin, Mecklenburg, Roanoke, Bedford, Campbell, Charlotte, Carroll, Brunswick, Montgomery, Botetourt, Floyd, and Appomattox; cities - Roanoke, Salem, Martinsville, Danville, Bedford, and South Boston.

The climate in the Roanoke River Basin is moderate but varied, with an average annual temperature of 56°F. This average ranges from 54°F in the Valley and Ridge Province to 59°F in the Piedmont Province. Extreme temperatures of 107°F and -1°F have been recorded. Average annual precipitation is approximately 44 inches. This varies from 37 inches at Concord to 50 inches at Peaks of Otter. The average annual snowfall is 12 inches.

The Roanoke River Basin is divided into six USGS hydrologic units as follows: HUC 03010101 - Upper Roanoke; HUC 03010102 - Middle Roanoke; HUC 03010103 - Upper Dan; HUC 03010104 - Lower Dan; HUC 03010105 - Banister, and HUC 03010106 - Roanoke Rapids.

Basin assessment information is presented in Tables 2.6-4-1, 2.6-4-2, 2.6-4-3.

TABLE 2.6-4-1

ROANOKE RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Monitored:

Rivers -2,209.46 miles
 Lakes - 97,848.20 acres
 Estuaries - 0 sq. miles

Basin Size

Rivers-9,392miles
 Lakes - 97,910acres
 Estuaries -0 sq. miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	2,054.91	1,241.63	81.24	20.89	3337.46
	Lake	97,910.40	0	0	0	97910.4
	Estuary	-	-	-	-	0
Fish Consumption	River	9,332.08	35.67	55.79	0	9423.54
	Lake	28,642	69,268	0	0	97910.4
	Estuary	-	-	-	-	0
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	-	-	-	-	0
Swimming	River	263.58	308.45	264.94	186.95	1023.92
	Lake	97,910.40	0	0	0	97910.4
	Estuary	-	-	-	-	0
Drinking Water	River	1,907.90	0	0	0	1907.9
	Lake	73,339.80	0	0	0	73339.8

	Estuary	-	-	-	-	0
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TABLE 2.6-4-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN ROANOKE BASIN

Cause of Impairment	Type	Major impact	Moderate/ Minor Impact
General Standards (Benthic)	River (mi)	0	26.72
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Unknown Toxicity	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pesticides	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics (PCB's)	River (mi)	0	55.79
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Siltation	River (mi)	11.43	35.24
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	9.46	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Thermal Modification	River (mi)	0	1.24
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	186.95	264.94
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Alterations	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 2.6-4-3 SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN ROANOKE BASIN

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Municipal Point Sources	River (mi)	8.95	21.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Combined Sewer Overflow	River (mi)	20.00	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	89.87	170.27
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Silviculture	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Construction	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	22.56	33.78
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Land Disposal	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	0	1.24
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Source Unknown	River (mi)	57.00	134.36
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Modification	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Hydromodification	River (mi)	9.46	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

Chowan River-Dismal Swamp Basin

The Chowan River and Dismal Swamp Basin is located in the southeastern portion of Virginia and covers 4,061 square miles or approximately 10 percent of the Commonwealth's total area.

The Basin extends eastward from Charlotte County to the Chesapeake Bay. The Chowan River-Dismal Swamp Basin in Virginia is defined by both hydrologic and political boundaries. The basin is bordered by the James River Basin and the Small Coastal River Basins to the east, the Roanoke River Basin to the west and the Virginia/North Carolina State line to the south. The basin is approximately 145 miles in length and varies from 10 to 50 miles in width. The Chowan River-Dismal Swamp Basin flows through the Piedmont and Coastal Plain Physiographic Provinces. The Chowan portion flows 130 miles from east to west, crossing both the Piedmont and Coastal Plain, while the Dismal Swamp lies entirely within the Coastal Plain. The Piedmont portion is characterized by rolling hills, steeper slopes and somewhat more pronounced stream valleys. The Coastal Plain, in contrast, is nearly flat with a descending series of terraces.

The Chowan River-Dismal Swamp Basin is mostly rural with approximately 64 percent of its land covered by forest. Cropland and pasture make up another 28 percent, while only about 6 percent is classified as urban.

The 1994 population for the Chowan River-Dismal Swamp Basin was approximately 586,276. All or portions of the following 14 counties and three cities lie within the basin: Counties - Greensville, Lunenburg, Southampton, Sussex, Brunswick, Charlotte, Dinwiddie, Isle of Wight, Mecklenburg, Nansemond, Nottoway, Prince Edward, and Surry; Cities - Chesapeake, Franklin, Suffolk, and Virginia Beach.

The climate of the Chowan River-Dismal Swamp Basin is moderate due to its proximity to the Atlantic Ocean, its latitude, topography, and prevailing winds. The average annual temperature is 59°F with extremes of 107 and -3°F having been recorded. Average annual precipitation is approximately 47 inches. This varies from 48 inches in Holland in the east, to 42 inches in Blackstone in the west. The average annual snowfall is 11 inches.

Major tributaries of the Chowan River are the Meherrin, the Nottoway and the Blackwater. The Nottoway and the Blackwater join at the Virginia/North Carolina state line to form the Chowan River. The Dismal Swamp portion is mostly flat with many swamp and marshland areas.

The Chowan River-Dismal Swamp Basin is divided into five USGS hydrologic units as follows: HUC 03010201 - Nottoway; HUC 03010202 - Blackwater; HUC 03010203 - Chowan; HUC 03010204 - Meherrin; and HUC 03010205 - Albemarle Sound. The five hydrologic units are further divided into 44 waterbodies or watersheds.

Basin assessment information is presented in Tables 2.6-5-1, 2.6-5-2, 2.6-5-3.

TABLE 2.6-5-1

CHOWAN-DISMAL SWAMP BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Monitored:

Rivers -1,867.66 miles
 Lakes - 4,558.50 acres
 Estuaries - 82.90 sq. miles

Basin Size

Rivers -4906 miles
 Lakes - 5,029.30 acres
 Estuaries -83 sq miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	1,109.03	352.81	208.08	198.29	1868.21
	Lake	5,029.30	0	0	0	5029.3
	Estuary	0	82.89	0.01	0	82.9
Fish Consumption	River	4,901.68	0	0	0	4901.68
	Lake	5,029.30	0	0	0	5029.3
	Estuary	82.90	0	0	0	82.9
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	0	0	0	0	0
Swimming	River	1,518.94	179.77	9.83	0.05	1708.59
	Lake	5,029.30	0	0	0	5029.3
	Estuary	82.78	0	0.12	0	82.9
Drinking Water	River	119.60	0	0	0	119.6
	Lake	587.00	0	0	0	587
	Estuary	0	0	0	0	0

TABLE 2.6-5-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN CHOWAN-DISMAL SWAMP BASIN

Cause of Impairment	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthic)	River (mi)	2.70	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Known Toxicity (Ammonia)	River (mi)	2.70	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pesticides	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	169.87	121.07
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Siltation	River (mi)	3.82	3.15
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	177.28	184.93
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.01
Pathogen Indicators	River (mi)	0.05	9.83
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.12
Dioxins	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Alterations	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 2.6-5-3 SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN CHOWAN-DISMAL SWAMP BASIN

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	2.70	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Municipal Point Sources	River (mi)	3.82	9.83
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Combined Sewer Overflow	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.01
Silviculture	River (mi)	0	3.15
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Construction	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Resource Extraction	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Land Disposal	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	194.47	184.93
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.01
Source Unknown	River (mi)	2.05	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Other/Water Quality Standards	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

Tennessee-Big Sandy River Basin

The segment of the Tennessee and Big Sandy River Basin which lies in Virginia is made up of the Holston, Clinch-Powell, and Big Sandy River Subbasins. These subbasins are located in the extreme southwest portion of Virginia and cover 4,140 square miles or approximately 10.5 percent of the Commonwealth's total land area.

The Virginia portion of the Tennessee-Big Sandy River Basin is defined by both hydrologic and political boundaries. The West Virginia State line lies to the northeast, Kentucky to the west, and Tennessee to the south. The New River Basin makes up the eastern boundary.

While the Tennessee and Big Sandy Rivers are fed by numerous southwest Virginia streams, neither river forms within the Commonwealth itself. The Big Sandy subbasin contains the Levisa and Tug Forks which flow northward into Kentucky forming the Big Sandy River. The Tennessee River is formed in Tennessee by the southwestward flowing Holston, Clinch and Powell tributaries. Both of the major river subbasins eventually empty into the Gulf of Mexico via the Ohio and Mississippi Rivers.

The Tennessee-Big Sandy River Basin spans three physiographic provinces: the Cumberland Plateau, Valley and Ridge, and the Blue Ridge. The Big Sandy portion of the basin lies within the Cumberland Plateau. This province is characterized as rugged, with mountainous terrain and steep valleys. The Tennessee portion, lying in the Valley and Ridge Province, is characterized by parallel valleys and ridges running in a northeast to southwest direction. A small portion, located in the Blue Ridge Province, is more plateau-like, with no single, prominent ridge which characterizes the Ridge and Valley province to the north.

Within Virginia, approximately 48 percent of the Tennessee River Basin is forested, while cropland and pasture make up another 39.7 percent. The Big Sandy portion of the basin is approximately 86 percent forest, with only about 5 percent in cropland and pasture. Urban areas make up only a small percentage of the total land area.

The 1994 population for the Tennessee-Big Sandy River Basin was approximately 310,309, or 5 percent of Virginia's total population. All or part of the following jurisdictions lie within the basin: counties - Lee, Scott, Russell, Washington, Smyth, Tazewell, Buchanan, Dickinson, Bland, Wythe, Grayson and Wise; cities - Norton and Bristol.

The climate of the Tennessee portion of the basin is considered temperate with an average annual temperature of 53°F. Temperatures of 105°F and -27°F have been recorded. Average annual precipitation in the basin is approximately 45.5 inches with an average annual snowfall of 15 to 20 inches. The climate of the Big Sandy portion of the basin is considered moderate with an average annual temperature of 54°F. Extremes of 100°F and -23°F have been recorded. Average annual precipitation is 44 inches, with an annual snowfall of 20 to 30 inches.

The Tennessee-Big Sandy River Basin is divided into six USGS hydrologic units as follows: HUC 05070201 - Tug Fork; HUC 05070202 - Upper Levisa; HUC 06010101 - North Fork Holston; HUC 06010102 - South and Middle Fork Holston; HUC 06010205 - Upper Clinch; and HUC 01010206 - Powell River. The six hydrologic units are further divided into 48 waterbodies or watersheds.

Basin assessment information is presented in Tables 2.6-6-1, 2.6-6-2, 2.6-6-3.

TABLE 2.6-6-1

TENNESSEE - BIG SANDY RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY

Total Size Monitored:

Rivers - 3,174.02 miles
 Lakes - 3,107.00 acres
 Estuaries -0 sq. miles

Basin Size

Rivers-5,037miles
 Lakes - 9,491acres
 Estuaries -0 sq.miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	1,342.43	1566.62	175.26	57.18	3141.49
	Lake	3,107.00	0	0	0	3107
	Estuary	-	-	-	-	0
Fish Consumption	River	5,756.39	0	0	80.40	5836.79
	Lake	3,107.00	0	0	0	3107
	Estuary	-	-	-	-	0
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	-	-	-	-	0
Swimming	River	532.59	53.96	22.75	111.41	720.71
	Lake	3,107.00	0	0	0	3107
	Estuary	-	-	-	-	0
Drinking Water	River	109.07	0	0	0	109.07
	Lake	3,107.00	0	0	0	3107
	Estuary	-	-	-	-	0

**TABLE 2.6-6-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN TENNESSEE-
BIG SANDY BASIN**

Cause of Impairment	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthic)	River (mi)	48.09	59.40
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Unknown Toxicity	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pesticides	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	80.40	38.10
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	5.94	38.10
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Siltation	River (mi)	0	37.07
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	17.67	16.50
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Thermal Modification	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	111.41	22.75
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Alterations	River (mi)	0	38.10
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

**TABLE 2.6-6-3 SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN TENNESSEE-
BIG SANDY BASIN**

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Municipal Point Sources	River (mi)	1.52	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Grazing Related Sources	River (mi)	0	37.23
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	16.50	5.69
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Silviculture	River (mi)	0	5.69
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	51.09	57.48
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Resource Extraction	River (mi)	33.57	97.87
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Land Disposal	River (mi)	68.66	22.75
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Source Unknown	River (mi)	0	29.74
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Modification	River (mi)	1.87	12.30
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Point/Source/Nonpoint Source	River (mi)	0.74	5.33
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	80.40	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

Chesapeake Bay and Small Coastal Basins

The Chesapeake Bay/Small Coastal Basin is located in the eastern part of Virginia and covers 1,588 square miles or approximately 4 percent of the Commonwealth's total land area. The basin encompasses the small bays, river inlets, islands and shoreline immediately surrounding the Chesapeake Bay and the southern tip of the Delmarva Peninsula. This basin also includes the Chesapeake Bay itself.

The Chesapeake Bay/Coastal Basin is defined by both hydrologic and political boundaries. The basin is bordered by the Potomac River Basin, the Rappahannock River Basin, the York River Basin, the James River Basin, and the Chowan River-Dismal Swamp Basin to its west. The Eastern Shore portion is bordered on the east by the Atlantic Ocean, on the north by Maryland, and on the west and south by the Chesapeake Bay.

The topography of the Chesapeake Bay/Coastal Basin varies little. The entire basin lies within the Coastal Plain Physiographic Province where elevations average no more than a few feet above sea level. More significant elevation occurs along the central spine of the Eastern Shore portion, which forms a plateau about 45 feet above sea level. Much of the Chesapeake Bay/Coastal Basin is marshland.

About 30 percent of the Chesapeake Bay/Coastal Basin is forested, while nearly 21.6 percent is in cropland and pasture. Approximately 24 percent is considered urban.

The 1994 population for the Chesapeake Bay/Coastal Basin was approximately 385,716. All or portions of the following jurisdictions lie within the basin: counties -Accomack, Northampton, Matthews, Northumberland, Lancaster, Middlesex, Gloucester, York, and Nansemond; cities - Portsmouth, Norfolk, Chesapeake, Virginia Beach, Hampton and Newport News.

The climate in the Chesapeake Bay/Coastal Basin is moderate and influenced primarily by the Atlantic Ocean. The annual average temperature is 58°F. Extremes of 106°F and -5°F have been recorded. Average annual precipitation in the basin is approximately 44 inches. Influence from the Atlantic Ocean causes wide variations in the monthly rainfall. Average annual snowfall is less than 10 inches.

Tributaries in the Chesapeake Bay/Coastal Basin drain into the Chesapeake Bay or the Atlantic Ocean. Major tributaries flowing into the Chesapeake Bay are the Great Wicomico, Piankatank, Fleets Bay, Mobjack Bay, (East, North, Ware, and Severn Rivers) Poquoson, Back River and Lynnhaven which flow from the mainland. Tributaries in the Eastern Shore portion that drain into the Bay are Pocomoke, Onancock, Pungateague, Occohannock, and Nassawadox. Machipongo River, Cat Point Creek, Assawoman Creek, Parker Creek, Folly Creek, and Finney Creek drain directly into the Atlantic Ocean.

The Chesapeake Bay/Coastal Basin is divided into seven USGS hydrologic units as follows: HUC 02060009 - Pocomoke River; HUC 02060010 - Chincoteague Bay; HUC 02080101 - Mainstem open bay; HUC 02080102 - Upper Western Shore Tributaries; HUC 02080108 - Lower Western Shore Tributaries; HUC 02080109 - Tributaries on the Eastern Shore which drain to the Chesapeake Bay; and HUC 02080110 - Tributaries on the Eastern Shore which drain to the Atlantic Ocean. The seven hydrologic units are further divided into 31 waterbodies or watersheds.

Basin assessment information is presented in Tables 2.6-7-1, 2.6-7-2, 2.6-7-3.

TABLE 2.6-7-1

CHESAPEAKE BAY-SMALL COASTAL BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Monitored:

Rivers - 203.72 miles
 Lakes - 3,099.57 acres
 Estuaries - 1,786.20 sq. miles

Basin Size

Rivers -673 miles
 Lakes - 3,205 acres
 Estuaries - 1,829 sq. miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	218.99	298.61	4.40	0	522
	Lake	3,141.47	0	0	0	3141.47
	Estuary	97.28	1,523.39	144.01	64.01	1828.69
Fish Consumption	River	733.64	0	0	0	733.64
	Lake	3,141.47	0	0	0	3141.47
	Estuary	1,828.69	0	0	0	1828.69
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	1,792.88	1.82	32.15	0	1826.85
Swimming	River	481.20	1.90	4.30	0	487.4
	Lake	3141.47	0	0	0	3141.47
	Estuary	1,703.36	0.20	0.52	0.34	1704.42
Drinking Water	River	33.00	0	0	0	33
	Lake	1,563.80	0	0	0	1563.8
	Estuary	-	-	-	-	0

TABLE 2.6-7-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN CHESAPEAKE BAY - SMALL COASTAL BASIN

Cause of Impairment	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthic)	River (mi)	0	1.50
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Known Toxicity (Ammonia)	River (mi)	0	1.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pesticides	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Siltation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	0	1.90
	Lakes (acres)	0	0
	Estuary (mi ²)	64.01	144.01
Thermal Modification	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	0	4.30
	Lakes (acres)	0	0
	Estuary (mi ²)	7.35	26.26
Habitat Alterations	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 2.6-7-3
CHESAPEAKE

SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN
BAY-SMALL COASTAL BASIN

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	0	3.30
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Municipal Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Combined Sewer Overflow	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	0	1.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.08
Silviculture	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0.33	0.52
Land Disposal	River (mi)	0	1.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	0	1.90
	Lakes (acres)	0	0
	Estuary (mi ²)	64.01	144.01
Source Unknown	River (mi)	0	1.50
	Lakes (acres)	0	0
	Estuary (mi ²)	0.01	0
Habitat Modification (Debris/Bottom Deposits)	River (mi)	0	1.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Other/Water Quality Standards	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Shellfish Condemnation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	32.15

York River Basin

The York River Basin lies in the central and eastern section of Virginia and covers 2,662 square miles or 7 percent of the Commonwealth's total area. It is defined by hydrologic boundaries. The basin is bounded by the Rappahannock River Basin to the north and east and the James River Basin to the south and west.

The headwaters of the York River begin in Orange County and flow in a southeasterly direction for approximately 220 miles to its mouth at the Chesapeake Bay. The basin's width varies from five miles at the mouth to 40 miles at its headwaters.

The basin is comprised of the York River and its two major tributaries, the Pamunkey and the Mattaponi. The York River itself is only about 30 miles in length. The Pamunkey River's major tributaries are the North and South Anna Rivers and Little River, while the major Mattaponi tributaries are the Matta, the Po and the Ni Rivers.

Lying in the Piedmont and Coastal Plain physiographic provinces, the basin's topography is characterized by slightly rolling hills at the headwaters or extreme western portion, to gently sloping hills and flat farmland near its mouth. Tributaries in the central Piedmont exhibit moderate and near constant profiles. Streams in the Coastal Plain are largely characterized by their flat slope. Approximately 65 percent of the river basin land is forested. Farmland and pasture accounts for approximately 20 percent of the land area while approximately 10 percent of the river basin land area is urban.

The 1994 population for the York River Basin was approximately 250,332. The majority of the population is rural, evenly distributed throughout the basin. No major cities lie within the basin.

All or portions of the following twelve counties lie within the basin: Caroline, Goochland, Hanover, Louisa, Orange, Spotsylvania, Gloucester, James City, King and Queen, King William, New Kent, and York.

The climate of the basin is moderate. The average annual temperature is 57°F. Extremes of below zero and above 100°F have been recorded. The average annual precipitation is approximately 43 inches. Annual rainfall varies very little throughout the basin, averaging from 42 to 46 inches. The average annual snowfall is light, ranging from 10 inches along the coastal portion to 15 inches in the upper Piedmont area.

The York River Basin is divided into three USGS hydrologic units as follows: HUC 02080102 - York River Subbasin, HUC 02080105 - Mattaponi River Subbasin; HUC 02080106 and Pamunkey River Subbasin. The three hydrologic units are further divided into 23 waterbodies or watersheds.

Basin assessment information is presented in Tables 2.6-8-1, 2.6-8-2, 2.6-8-3.

TABLE 2.6-8-1

YORK RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Monitored:

Rivers - 512.46 miles
 Lakes - 1,026.50 acres
 Estuaries - 93.63 sq. miles

Basin Size

Rivers - 3,375 miles
 Lakes - 14,633 acres
 Estuaries - 94 sq. miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	250.08	342.47	10.70	12.67	615.92
	Lake	1,511.50	0	0	0	1511.5
	Estuary	18.29	69.97	5.39	0	93.65
Fish Consumption	River	3,178.77	0	0	0	3178.77
	Lake	1,511.50	0	0	0	1511.5
	Estuary	93.65	0	0	0	93.65
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	50.08	0.17	12.90	0	63.15
Swimming	River	383.67	60.38	20.72	7.89	472.66
	Lake	1,511.50	0	0	0	1511.5
	Estuary	91.65	0	1.75	0.40	93.8
Drinking Water	River	88.18	0	0	0	88.18
	Lake	715.00	0	0	0	715
	Estuary	-	-	-	-	0

TABLE 2.6-8-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN YORK BASIN

Cause of Impairment	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthic)	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Unknown Toxicity	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pesticides	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	5.49	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	18.16	17.30
	Lakes (acres)	0	0
	Estuary (mi ²)	0	5.23
Siltation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.16
Thermal Modification	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	7.89	20.72
	Lakes (acres)	0	0
	Estuary (mi ²)	0.40	14.65
Habitat Alterations	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 2.6-8-3 SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN YORK BASIN

Source of Impairment	Type	Major impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Municipal Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Combined Sewer Overflow	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	2.60	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Silviculture	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Resource Extraction	River (mi)	5.49	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	12.67	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0.40	5.64
Source Unknown	River (mi)	5.29	25.82
	Lakes (acres)	0	0
	Estuary (mi ²)	0	1.35
Habitat Modification	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Shellfish Condemnation	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	12.90

New River Basin

The New River Basin is located in southwest Virginia and covers 3,070 square miles or approximately 8 percent of the Commonwealth's total land area. The New River flows from its headwaters in Watauga County, North Carolina in a northeasterly direction to Radford, Virginia and then in a northwesterly direction to Glen Lyn, where it exits into West Virginia. There it flows to the confluence of the Gauley River forming the Kanawha River, a tributary to the Ohio River.

The New River Basin in Virginia is defined by both hydrologic and political boundaries. It is bordered by the James River Basin and Roanoke River Basin to the east, and the Big Sandy River Basin and Tennessee River Basin to the west. The southern boundary of the Virginia portion is the North Carolina State line and its northwest boundary is the West Virginia State line.

The New River Basin runs 115 miles in length from Blowing Rock, North Carolina to Bluestone Dam near Hinton, West Virginia with a maximum width of 70 miles near Rural Retreat Virginia. The Virginia portion of the New River Basin is 87 miles in length.

The topography of the New River Basin is generally rugged, the upper reaches of its tributaries being extremely steep. High mountains, narrow valleys and steep ravines characterize the basin. There are ten tributaries in the Upper New River Basin each having more than 100 square miles in drainage area and many others with forty or more square miles.

The New River Basin is the least densely populated of the Commonwealth's major river basins. The higher elevations of the basin have steep slopes and are thickly forested, while the mountain bases are mostly used for agriculture. Approximately 59 percent of its land is forested. Cropland and pasture make up another 35 percent, with approximately 3 percent considered urban.

The 1994 population for the New River Basin was approximately 211,673. All or portions of the following 11 counties lie within the basin: Grayson, Carroll, Smyth, Wythe, Pulaski, Floyd, Montgomery, Tazewell, Bland, Giles, and Craig and the cities of Galax and Radford.

The climate of the New River Basin is determined by the geographical location of the basin on the North American Continent, its latitude, its proximity to the Atlantic Ocean and its topography. The average annual temperature is 53°F ranging from a high of 55°F at Glen Lyn to a low of 50°F at Burkes Garden. Extremes of -27°F to 103°F have been recorded. Average annual precipitation is approximately 40 inches. This varies from 36 inches in the central part of the basin to 45 inches in the western, eastern and southern portions. The average annual snowfall is 22 inches ranging from 20 inches in the central and eastern portions to 30 or more inches in the higher elevations.

The New River Basin is divided into two USGS hydrologic units as follows: HUC 05050001 - Upper New; and HUC 05050002 - Middle New. The two hydrologic units are further divided into 35 waterbodies or watersheds.

Basin assessment information is presented in Tables 2.6-9-1, 2.6-9-2, 2.6-9-3.

TABLE 2.6-9-1

NEW RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Monitored:	Basin Size
Rivers - 2,301.82 miles	Rivers - 4,099 miles
Lakes - 4,798.50 acres	Lakes - 5,218 acres
Estuaries - 0 sq. miles	Estuaries - 0 sq. miles

Use	Water Body Type	Size Fully Supporting	Size Fully Supporting but Threatened	Size Partially Supporting	Size Not Supporting	Total Size Assessed
Aquatic Life	River	1,107.56	1399.31	34.94	7.25	2549.06
	Lake	153.50	4,645.00	0	0	4798.5
	Estuary	-	-	-	-	0
Fish Consumption	River	4,098.54	0	0	0	4098.54
	Lake	4,798.50	0	0	0	4798.5
	Estuary	-	-	-	-	0
Shellfishing	River	-	-	-	-	0
	Lake	-	-	-	-	0
	Estuary	-	-	-	-	0
Swimming	River	469.04	52.89	10.96	31.95	564.84
	Lake	4,798.50	0	0	0	4798.5
	Estuary	-	-	-	-	0
Drinking Water	River	80.00	0	0	0	80
	Lake	4,685.50	0	0	0	4685.5
	Estuary	-	-	-	-	0

TABLE 2.6-9-2 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN NEW BASIN

Cause of Impairment	Type	Major impact	Moderate/ Minor Impact
General Standards (Benthic)	River (mi)	0	26.16
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Unknown Toxicity	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pesticides	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	0	0.60
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
pH	River (mi)	0	8.10
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Siltation	River (mi)	4.41	6.05
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	2.84	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Thermal Modification	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	31.95	10.96
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Alterations	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 2.6-9-3 SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN NEW BASIN

Source of Impairment	Type	Major impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Municipal Point Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Combined Sewer Overflow	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	29.11	2.13
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Silviculture	River (mi)	0	2.13
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	0	30.83
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Resource Extraction	River (mi)	0	8.10
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Land Disposal	River (mi)	2.84	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Source Unknown	River (mi)	2.84	6.89
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Modification	River (mi)	4.41	6.05
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Collection System Failure	River (mi)	2.84	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

Chapter 3.1 SURFACE WATER MONITORING PROGRAMS

Ambient Water Quality Monitoring (AWQM)

Sixteen hundred and twenty (1,620) stations were sampled during this reporting period to determine water quality trends and conditions in the state for identification and ranking of Virginia's priority water bodies and for reporting purposes in this 305(b) Water Quality Assessment Report. These stations include 1,349 ambient water quality stations and 271 biological monitoring stations. Stations are located to gather information from industrial, urban, rural, and undeveloped areas of the state. These data are gathered near industrial and municipal discharges, nonpoint source areas, public water supplies, unaffected areas, and previously unassessed areas. In this way, stream miles at risk from major pollution sources are well documented, as are those where pollution risk is suspected or unknown. Station selections are made by regional office personnel who are most familiar with local conditions and concerns.

The number of stations representing a particular type of stream area, the types of samples collected, the parameters analyzed, and the sampling frequency all vary with prevailing conditions, and program emphasis. Types of samples collected include water, sediment, fish tissue, and benthos. All stations are monitored for conventional parameters and about one-third are monitored for toxics in the water column and/or in the sediments. Areas with potentially greater risk are sampled more frequently, with more types of samples being collected. As the risk or the need to document the risk decreases, the sampling frequency and the number of the types of samples collected decreases. This variation allows greater resource flexibility. Table 3.1-1 gives an outline of the frequency of sampling and parameters covered for given sample types.

The monitoring network includes ambient water quality, benthic, Chesapeake Bay tributary, and fish tissue monitoring stations, as well as stations located specifically for special studies. During this reporting period, DEQ collected approximately 39,000 samples.

Each basin summary, found in Chapter 2.6 of this report, lists the ambient water quality monitoring (AWQM) and biological (benthic) monitoring summary data within the basin. In some basins, STORET data produced from Tennessee Valley Authority (TVA) and USGS monitoring operations are included in order to provide better assessment of water quality. Summaries of the sampling data collected at each station during the reporting period are provided in Appendix B of this report. All chemical and physical data (except for special studies) collected at the AWQM stations are entered into EPA's STORET database.

Data Management

Virginia uses EPA's STORET database for data storage. DEQ uses an electronic data transfer system whereby data are reported by the laboratory, screened for QA/QC problems and standards violations, and sent to STORET. Restricted DEQ personnel may correct, delete or erase stored data using an electronic interface with STORET. Data are managed by regional and central office personnel using routines resident in the STORET environment and by downloading STORET data to local PC environments and using in-house software. All DEQ monitoring data are available on-line to anyone with STORET access. Data can be provided to persons without such access in hard copy and digital formats by contacting the DEQ STORET coordinator.

Water	Sediment	Tissue	Benthos
<u>Parameters:</u>			
DO	Metals	Species Population	
Temperature	Pesticides	Length	Variation
pH	Organics	Weight	Diversity
Bacteria			
Solids			
Nutrients			
Conductivity			
Salinity			
Secchi			
Alkalinity			
Acidity			
Total Solids			
Suspended Solids			
Dissolved Solids			
Silica			
Sulfide			
Color			
Tannin & Lignin			
BOD			
COD			
TOC			
Hardness			
Chloride			
Fluoride			
Metals			
Pesticides			
Organics			
Chlorophyll			
Algae			
<u>Sampling Frequency:</u>			
Annual	Annual	Annual	Semiannual
Semiannual	Semiannual	Semiannual	
Quarterly	Quarterly	Quarterly	
Monthly			

Beginning in January 1999, water quality data will be electronically stored in STORETX, a new database application replacing the current STORET database. STORETX will store additional data, including expanded station descriptions, quality control data from the laboratory, more complex

project information, and better biological parameter storage.

Fish Tissue Monitoring Program

Sampling stations used in this program are selected for their proximity to industrial areas, importance as major waterways and fishing areas, sites previously unsampled and/or sites identified as areas of possible contamination.

Two composite samples of edible fillets, obtained from fish species normally consumed by humans, were collected at each sampling station in order to address human health concerns. Ecosystem contamination data was collected at each station by collecting one whole body composite sample of a bottom-feeding species. Samples were analyzed for heavy metals, pesticides, and trace organics. The following is a list of those compounds analyzed.

Metals: Pesticides:

Arsenic Aldrin		Endosulfan (alpha)
Beryllium	Dieldrin	Endosulfan (beta)
Cadmium	Endrin	PCBs
Chromium	DDT	Toxaphene
Copper	DDE	Benzene hexachloride (alpha)
Lead	DDD	Benzene hexachloride (beta)
Mercury	Chlordane	Lindane
Nickel	Heptachlor	Benzene hexachloride (delta)
Selenium	Heptachlor epoxide	Chlorpyrifos-methyl
Silver	Hexachlorobenzene	Mirex
Thallium	Methoxychlor	Oxychlordane
Zinc	Nonachlor	Pentachloroanisole

Other Organics:

Acenaphthane		Diethylphthalate
Acenaphthylene		Dimethylphthalate
Anthracene		Fluoranthene
1,2 Benzanthracene		Fluorene
Benzo (a) pyren	Ideno (1,2,3-cd) pyrene	
3,4 Benzofluoranthene		Naphthalene
Benzo (k) fluoroanthene		4,6-Dinitro-2-methylphenol
1,1,2, Benzoperylene		N-Nitrosodiphenylamine
4-Bromophenyl phenylether		N-Nitroso-di-N-propylamine
4 Chloro-3-methylphenol		Phenanthrene
2-Chloronaphthalene		Bis (2-ethyl-hexyl) phthalate
4-Chlorophenolphenylether		Butylbenzylphthalate
Chrysene		Di-N-butylphthalate
Dibenzo (a,h) anthracene		Di-N-octylphthalate
3,3-Dichlorobenzidine		Pyrene
2,4-Dimethylphenol		1,2,4-Trichlorobenzene

Benthic Macroinvertebrate Monitoring Program

The Biological Monitoring Program (BMP) utilizes the study of bottom dwelling macroinvertebrate communities to determine overall water quality. Changes in water quality generally result in changes in the kinds and numbers of these animals which occur in streams or other waterbodies.

The majority of the freshwater benthic macroinvertebrates found in Virginia come from four general groups: insects, molluscs, crustaceans, and annelid worms. Beside being the major intermediate constituent of the aquatic food chain, benthic macroinvertebrates are "living recorders" of past and present water quality conditions. This is due to their relative immobility and their variable resistance to the diverse contaminants which can be introduced into streams. No two groups of benthic organisms have the same limiting factor for the various chemical and physical constituents encountered in the aquatic ecosystem. The community structure of these organisms provides the basis for the biological analysis of water quality.

The BMP is composed of stations examined annually during the spring and fall. Qualitative and semiquantitative biological monitoring has been conducted by the agency since the early 1970's. The US EPA Rapid Bioassessment Protocol (RBP) II was employed beginning in the fall of 1990, to utilize standardized and repeatable methodology. The RBP's produce water quality ratings of nonimpaired, moderately impaired, and severely impaired instead of the former ratings of good, fair and poor.

The procedure evaluates the macroinvertebrate community by comparing ambient monitoring "network" stations to "reference" sites. A reference site is one which has been judged to be representative of a natural, unimpaired waterbody. The RBP evaluation also accounts for the natural variation noted in streams in different ecoregions. One additional product of the RBP evaluation is a habitat assessment. This provides information on the comparability of each stream station to the reference site.

The results of data analyses and locations of stations are presented in Appendix B of this report. Like physical and chemical water quality monitoring data, biological monitoring data are used to assess water quality for support of designated uses and the Clean Water Act fishable and swimmable goals.

Volunteer Monitoring Program

The 1998 305(b) report is the fifth in which volunteer-collected data were recognized when making water quality assessments. Volunteer data were obtained from the Alliance for the Chesapeake Bay (ACB) and the Izaak Walton League of America (IWLA). Both organizations maintain volunteer water quality monitoring networks in Virginia. Interest in environmental stewardship in the Commonwealth is strong, as evidenced by the yearly increases in volunteer monitoring programs throughout the state. As the number of volunteer participants grows, so too, does the number of stations evaluated by these organizations. Data collected by citizen monitors will continue to be an important element in Virginia's attempt at a thorough statewide water assessment.

Volunteers for the ACB have been monitoring water quality since 1985. This program is administered under the guidance of the Monitoring Subcommittee to the Implementation Committee for the interstate Chesapeake Bay Program. In Virginia, stations have been established on the James, York, Rappahannock, Piankatank, Potomac, Elizabeth, Chickahominy, Mattaponi, Pamunkey and Lynnhaven River, as well as on the creeks and embayments of the Eastern Shore. Air and water temperature, Secchi disk depth, pH, DO, and salinity are measured at all ACB sites. Field observations of water conditions and color, weather, and general conditions of the site are also made at every

sampling location. At seven monitoring stations, samples were taken for inorganic nutrients (nitrate, ammonia, nitrite, and ortho-phosphate) in addition to their standard parameters. At most sampling locations, physical and chemical monitoring samples are taken on a weekly basis. The citizen monitors for ACB work from a sampling protocol manual developed by the Alliance and a Quality Assurance and Control Project Plan that has been approved by the Environmental Protection Agency and Virginia DEQ. All volunteers must complete a rigorous initial training class and two quality control sessions each year which are administered by the Virginia coordinator for the Alliance.

The IWLA maintains a statewide volunteer water quality monitoring network through its "Save Our Streams" Program. Save Our Streams volunteers are trained in accordance with EPA-approved quality assurance/quality control guidelines to monitor benthic macroinvertebrate populations and assess physical stream characteristics. The program is coordinated on a statewide level through the Virginia Chapter of the IWLA. Surveys are made at regular intervals from each of more than 303 sites in 46 counties throughout Virginia. The resulting data are compiled and reported to the DEQ and the DCR.

Chapter 3.2 ASSESSMENT METHODOLOGY

Virginia's biennial water quality assessment begins by analyzing the water quality data from ambient, biological, sediment and fish tissue monitoring stations. The results of these comprehensive data analysis are compared with both numeric and narrative goals contained in the Water Quality Standards (WQS). The results of these comparisons are presented in the 305(b) and 303(d) reports. The WQS are provisions of State and/or Federal Law which contain the designated uses for the waters of the Commonwealth. Included in the standards are the numerical and narrative criteria for protecting these uses.

There are two basic types of water quality data used in the assessment process. "Monitored" data comes from the collection and analysis of chemical, biological, and physical samples taken by DEQ, U.S. Geological Survey, TVA, and/or other special studies. Monitored data is obtained through a sampling and testing protocol which has been approved by EPA. The second type of data used in the assessment is called "evaluative" data. This physical, chemical, or biological data is primarily obtained from sources where there is not an EPA approved sampling and testing protocol or some other water quality "predictive" assessment technique. For the 305(b) report, only EPA approved "monitored" data is used to classify waters "impaired" due to the assessment confidence associated with quality control/quality assurance monitoring requirements." Evaluative" data are used to rank waters for potential water quality degradation or impairment and are used to assist in the siting of monitoring stations in the designated high ranking waters.

Designated Uses of Virginia's Waters

Virginia's water quality standards contain three basic designated uses of the state's waters and two associated uses. In the biennial water quality assessment process, a total of five designated uses are assessed. These designated uses are **aquatic life use, recreational use (swimming), use as public water supply**. Along with these three primary uses, **fish consumption and shellfish consumption**, which are sub-categories of the aquatic life use designated in the water quality standards, are assessed. Swimming use is assessed to represent the primary and secondary water contact recreational use.

Aquatic Life Use:

Includes the propagation, growth, and protection of a balanced indigenous population of aquatic life (including game and marketable fish) which may be expected to inhabit the waters.

Support of this use is determined by the assessment of conventional pollutants (dissolved oxygen, pH and temperature); toxic pollutants in the water column, toxic pollutant analysis of fish tissue and sediments and biological assessment of benthic communities.

Fish Consumption Use:

Support of this use is determined based on advisories and restrictions issued by the Virginia Department of Health (VDH). The public is advised that fish consumption is prohibited for the general population or there is an advisory that fish should not be consumed by the general population or subpopulations at greater risk such as children or pregnant women.

Shellfish Consumption Use:

Support of this use is based on restrictive actions for the harvesting and marketing of shellfish resources made by the Division of Shellfish Sanitation (DSS) of the Virginia Department of Health.

Four classifications are used to describe shellfish waters. They are approved, conditionally approved, restricted, and prohibited. Approved areas are waters from which shellfish may be taken for direct marketing at all times. Conditionally approved areas are waters where the quality may be affected by a seasonal population increase or sporadic use of a dock or harbor facility. Restrictive areas are waters where a sanitary survey indicates a limited degree of contaminants which makes it unsafe to market shellfish for immediate consumption. Shellfish harvested in these areas must be moved to an approved area for a certain length of time to allow for depuration before marketing. Prohibited areas are waters where the sanitary survey indicates dangerous numbers of pathogenic microorganisms or other contaminants which could affect human health. Shellfish cannot be harvested or relayed for purification in prohibited areas. Those areas which are determined as non-productive for shellfish will not be assessed for this use.

Swimming Use:

Includes swimming and other primary and secondary water contact recreation uses. Support of this use is based on fecal coliform bacteria data and the Department of Health (VDH) beach closures.

Public Water Supply Use:

Waters which are used for public drinking water supply are listed in the water quality standards and protected by additional standards which are applicable to these waters. Support of this use is based on Virginia Department of Health closures or advisories.

Table 3.2-1 is a summary of the designated uses and the criteria used to demonstrate the support of the associated designated uses.

Table 3.2-1 Designated Use Matrix

NO.	Designated Use	Support of Use Demonstrated By
1	Aquatic Life Use	Conventional Pollutants (DO, pH, Temp.); Toxics in water column; Fish tissue and sediments; Biological evaluation.
2	Fish Consumption Use	Advisories and restrictions issued by VDH.
3	Shellfish Consumption Use	Restrictive actions for harvesting and marketing of shellfish resources made by Div. of Shellfish Sanitation of VDH.
4	Swimming Use	Conventional Pollutant (Fecal Coliform Bacteria) and/or beach closures
5	Public Water Supply Use	Closures or advisories by VDH.

Designated Use Support Criteria

Fully Supporting:

Conventional Pollutants:

Waters fully supporting the designated uses can have up to 10% violations of a water quality

standards numeric criteria for conventional pollutants such as fecal coliform bacteria, dissolved oxygen, temperature, and pH. This procedure is based on EPA guidance which recommends states use a violation rate of water quality standards in the 0-10% range as fully supporting the designated uses. Data sets containing less than 13 observations are generally considered as insufficient data to statistically determine full support. The determination of the percentage exceeding the standard for conventional pollutants is determined by a binomial assessment method rather than an arithmetic percentage of number of exceedances divided by the total number of samples.

Toxic Pollutants in the Water Column with Water Quality Standards:

For toxic pollutant assessment of the water column, waters where the 97th percentile of the data is less than the water quality standard are generally considered fully supporting. The 97th percentile is determined by using DEQ's computer analysis method (Standard.exe) which is used in DEQ's VPDES permitting program. Additional information on the analysis of toxic data is described in Part VII Section 3 of the DEQ 305(b)/303(d) guidance manual.

Biological Data:

For Benthic Community assessment, data for the overall 5 year assessment period is rated as not impaired or slightly impaired where no biological assemblage (e.g. fish, macro invertebrates or algae) has been modified significantly beyond the natural range of reference conditions.

Fish Advisories:

Waters where the Department of Health has issued no fish advisories or prohibitions.

Shellfish Advisories:

Those growing areas where no restriction or prohibition on shellfish harvesting is imposed as indicated by the Department of Shellfish Sanitation (DSS) summary dated June 30, 1997.

Those growing areas where prohibitions and restrictions are due solely to the presence of a VPDES permitted outfall.

Discussion: In the meeting held with DSS on June 9, 1997, it was agreed that those shellfish growing waters which were prohibited or restricted for shellfish harvesting due solely to the presence of a VPDES outfall permitted by the authorized state agency would not be considered impaired. The rationale is the management decision made during the VPDES permit issuance process which removed shellfish harvesting as a beneficial use from the area impacted by the discharge.

Beach Closures:

No VDH beach closures during the 5 year assessment period.

Drinking Water Source Closures:

No VDH drinking water source closures during the 5 year assessment period.

Fully Supporting But Threatened

Threatened Waters:

Waters for which "evaluated" data, trend analysis, or other water quality indicators show an apparent decline in water quality or a potential water quality problem. Waters are designated threatened where there is a probable loss of a designated use documented by ancillary data such as recurrent fish kills or pollution documented by non-agency studies or reports. Threatened waters generally have some violations of water quality standards for conventional parameters or potential for moderately impaired biological conditions and should include additional monitoring.

Conventional Parameters and Fish Tissue/Sediment Contamination:

For conventional parameters, waters slightly exceeding the 10% violation rate based on the number of violations divided by the total number of samples but less than 10% based on the binomial distribution. Trend analysis on monitored data show a decline in water quality. Evaluated data shows a potential water quality problem.

For fish tissue or sediment contamination, waters exceeding a screening value (SV) or ER-M value, respectively. If ER-M value does not exist, then the 99th percentile value is used.

Biological Data:

Benthic Community data for the 5 year assessment period with a single rating of moderately impaired using RB II methodology. Evaluated benthic data or best professional judgement reveals potential water quality problems. Another biological assessment should be scheduled.

Shellfish Advisories:

Those growing areas which DSS has classified as conditionally approved. This would include those condemnations listed as seasonal condemnations in the DSS summary dated June 30, 1997.

Discussion: The restriction on direct marketing and requirement for relaying is in effect during a period of the year when virtually no harvesting occurs. During the period of the year when harvesting is active, the activity requiring the conditional approval is absent and no restrictions on marketability are imposed. Therefore, there is no significant impact to the resource. The area is considered threatened due to the presence of the activity which causes the temporary harvesting restriction.

Beach Closure:

One short term (less than one week in duration) VDH beach closure within the 5 year assessment cycle with a low probability, based on best professional judgement, that the pollution will reoccur. The source of the pollution causing the closure is generally transient and there are no VDH plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One short term VDH drinking water source closure during the 5 year assessment cycle with a low probability that the pollution will reoccur. The source of the pollution is generally transient and there are no VDH plans to implement pollution reduction measures or controls.

Impaired Waters

Conventional Parameters:

Impaired waters are those with long term or chronic water quality problems. Impaired waters are designated **partially supporting** or **not supporting** any of the five designated uses. The number of samples exceeding the standard is used to determine if the water is partially or not supporting. EPA guidance recommends that the states use a violation rate of 11% - 25% for partial support and greater than 25% for not supporting.

Toxic Parameters:

Impaired waters are those which the 97th percentile of the data exceeds the toxic pollutant water quality standard. The toxic standards protect aquatic life and human health uses (water supply). Waters failing to meet one of these uses should be designated as partially supporting. Waters should be designated not supporting when both uses are not met.

Discussion: EPA's 1998 assessment guidance determines partial support from not supporting by the arithmetic percentage (total exceedences / total samples x 100 = arithmetic percent) of samples exceeding the standard. Violations exceeding 10% are not supporting and violations of 10% or less are partially supporting. We do not agree with this method because the toxic standards are parameter and designated use specific. For example, the carcinogen trichlorophenol has a standard for human health use (drinking water) but none for aquatic life. Therefore, a violations in excess of 10% for this parameter can only be for the one designated use and partially supporting. Other toxic pollutants such as aldrin have standards for aquatic life and human health. Violations of the standard for both uses would be designated not supporting.

All localities, PDCs, Health Department Districts, and Soil and Water Conservation Districts are notified and provided information on the impaired waters within their jurisdictional boundaries.

Partially Supporting

Conventional Parameters:

Waters with long term or chronic problems based on the assessment of monitored data. For conventional parameters, violations of water quality standards in the 11-25% range (based on the binomial distribution) are considered a long term or chronic problem and considered partially supporting. Waters with violations in this range are capable of supporting some of the designated uses according to EPA guidance.

Toxic Pollutants:

For toxic parameters, waters violating the quality standard (97th percentile greater than the standard) for one designated use.

Biological Data:

Benthic community data rated as moderately impaired using more than one RBP II survey during the assessment period showing moderate impairment.

Fish Advisories:

Virginia Department of Health fish consumption advisories are considered violations of the general water quality standard and considered partially supporting. Where EPA and the Commonwealth have completed remedial action or decided not to implement control measures to remove or reduce the pollutants such as the kepone in the lower James River, a brief summary of the federal\state action and a statement that a TMDL will not be developed for these waters will be

included in the 303(d) report.

Shellfish Advisories:

Those growing areas which DSS has classified as restricted. This includes all shellfish condemnations which are not seasonal or other prohibitions as listed in the DSS summary dated June 30, 1997.

Discussion: The loss of resource in the restricted areas is a partial loss since the DSS allows harvesting and marketing after relay for cleansing of contamination. The waters therefore partially support the beneficial shellfish use.

Beach Closures:

One or more VDH beach closures of less than one week duration within the 5 year assessment cycle with a medium probability, based on best professional judgement, that the pollution will reoccur. There are VDH plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One or more VDH drinking water source closures within the 5 year assessment cycle with a high probability that the pollution will reoccur. There are plans to implement pollution reduction measures or controls.

Not Supporting

Conventional Parameters:

Waters with severe long term or chronic problems based on the assessment of monitored data. Waters with conventional parameter violations of greater than 25% (based on the binomial distribution) do not support any of the designated uses according to EPA guidance.

Toxic Pollutants:

Waters where the 97th percentile of the toxic parameter exceeds the water quality standard for more than one designated use.

Biological Data:

Benthic Community data for the 5 year assessment period rated as severely impaired.

Fish Consumption Advisories:

Virginia Department of Health fish consumption prohibitions are considered violations of the general water quality standard and considered as not supporting.

Shellfish Advisories:

Those growing areas which DSS has classified as prohibited, with the exception of those areas where prohibitions and restrictions are due solely to the presence of a VPDES permitted outfall. This includes those shellfish condemnations which are listed as "...it shall be unlawful for any person, firm, or corporation to take shellfish from these areas, for any purpose."

Discussion: The loss of resource in the prohibited areas is a total loss since the DSS does not allow relaying to remove contamination, harvesting, or marketing of the shellfish resource which may be present. The prohibitions and restrictions due solely to the presence of a VPDES permitted outfall are not considered as loss of beneficial use as explained in the discussion following the "Fully Supporting" section.

Beach Closures:

One or more VDH beach closures of more than one week duration during the five year period with a high probability, based on best professional judgement, that the pollution will reoccur and additional closures will result. VDH initiates plans to implement pollution reduction measures or controls.

Drinking Water Source Closure:

One or more VDH drinking water source closures with a high probability that the pollution will reoccur. There are VDH plans to implement pollution reduction measures or controls.

Waters Not Meeting Water Quality Standards Due to Natural Conditions

Waters which are assessed as exceeding 10% violations of standards (based on the binomial distribution) and the source of violations is due to naturally occurring conditions such as low DO in slow flowing swamp waters are not considered impaired. These violations are not a result of or related to human activity, past or present. The Commonwealth will not attempt to implement control measures, pollution reduction projects, or develop TMDLs for these waters.

Table 3.2-2 summarizes the designated use support criteria used in the water quality assessment.

Table 3.2-2 Designated Use Support Criteria Matrix

	Fully Supporting	Fully Supporting But Threatened	Partially Supporting	Not Supporting
Conventional Pollutants	$r \leq 10\% \text{ binomial}$	$10\% \text{ fix} \geq r \leq 10\% \text{ binomial}$	$10\% \text{ bin} < r \leq 25\% \text{ binomial}$	$r > 25\% \text{ bin}$
Toxic Pollutants	97th %tile < WQS	NA	97th %tile > WQS for one designated use (aquatic life or human health/water supply)	97th %tile > WQS for more than one designated use
Biological Data	Not Impaired or Slightly Impaired	Moderately Impaired; Evaluated data show potential WQ problems	Moderately Impaired (more than one surveys show moderate impairment)	Severely Impaired
Fish				

Advisories	None	NA	Yes	Yes
Shellfish Advisories	None	Areas classified as Conditionally Approved (includes seasonal condemnations)	Areas classified as Restricted	Areas classified as Prohibited (exception: VPDES outfall areas)
Beach Closures	None	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any controls)	One or more VDH closure with medium probability of recurrence (VDH preparing plans to implement controls measures)	One or more VDH closure with high probability of recurrence (VDH initiates plans to implement controls measures)
Drinking Water Source Closures	None	One short term VDH closure with low probability of recurrence (pollution source transient and no VDH plans to implement any controls)	One or more VDH closure with medium probability of recurrence (VDH preparing plans to implement controls measures)	One or more VDH closure with high probability of recurrence (VDH initiates plans to implement controls measures)

Fish Tissue Data*	Sediment Data*
<p>If one or more Level 1 samples exceed one or more risk based SVs ⇒ threatened for fish consumption and aquatic life.</p> <ul style="list-style-type: none"> •Cause: violation of SV for affected parameter •Source: unknown 	<p>If one or more ER-M SV(s) or if no ER-M exists, 99th percentile SV exceed ⇒ threatened for aquatic life.</p> <ul style="list-style-type: none"> •Cause: violation of SV for affected parameter

*No water body should be designated impaired (partially or not supporting) based on Level 1 Fish Tissue or Sediment data alone.

Delineation of Monitored Waters and Segments

The Virginia Department of Environmental Quality (DEQ) has approximately 1,349 active Ambient Water Quality Monitoring (AWQM) stations and 271 (69 reference) biological stations statewide. The AWQM stations are monitored bi-monthly, monthly or quarterly, while the biological stations are monitored twice a year usually in the Spring and Fall. Monitoring programs can be designed based on conventional (source targeted) or probability or a combination of the two. Each monitoring program design has its advantages and disadvantages. In the past, most of DEQ's monitoring strategy has been based on the conventional approach. Many of the stations were selected

due to point sources problems (VPDES permit dischargers). Over the recent years, some stations have been selected to monitor nonpoint source problems. In past 305(b) water quality assessment reports, there has been little consistency between the regions for determining the miles of stream impairment associated with each monitoring station. Most regions have strived to have at least one AWQM station in a watershed. If that station is determined to be representative of that watershed, then the total stream miles associated with that watershed were considered assessed. When an assessment revealed an impairment in water quality then the assessed miles for that specific monitoring station have been limited to a distance upstream and downstream which contains no significant change to water or habitat quality. The remaining stream miles have been evaluated as not assessed. In order to provide consistency between the regions and to get an accurate number of assessed stream miles in the state, the following guidelines are recommended:

- 1) One monitoring station should not be used to assess an entire watershed unless land use, source, and habitat are relatively homogeneous.
- 2) Typically no more than 10 miles of stream should be associated with a monitoring station for conventional pollutants as per EPA guidance. Miles assessed for a toxic pollutant or biological impairment may vary from the miles assessed for conventional pollutants.
- 3) When determining the miles assessed for a monitoring station, the following items need to be considered:
 - a) point or nonpoint source input to a stream or its tributaries,
 - b) changes in watershed characteristics such as land use,
 - c) changes in riparian vegetation, stream banks, substrate, slope, or channel morphology,
 - d) large tributary or diversion, or
 - e) hydrologic modification such as a channelization or a dam.

It is recommended that the above approach be phased in over the next couple of 305(b) assessment periods due to the many different considerations which must be made especially for physically or geographically changing watersheds.

Water Quality Data Assessment Methodology for Conventional Parameters

DEQ makes a biennial report to Virginia's citizens and EPA on the condition of its waters. The waters are evaluated in terms of whether five designated uses are met: 1) aquatic life, 2) swimming (primary and secondary contact recreation), 3) shellfish harvest, 4) fish consumption, and 5) drinking water use. DEQ employs a statistical method to evaluate waters for the first two uses, aquatic life use and swimming use. The following is a description of the conventional pollutant statistical method used in the 1998 305(b) Report.

Use Impairment:

Through water quality monitoring, DEQ collects data under varied environmental conditions such as cold/warm weather and dry/rainy conditions. Each field datum is compared against the regulatory standard that protects the use. Aquatic life use is maintained if the standards for the conventional pollutants DO, pH, and water temperature are met for greater than 90% of the samples analyzed. Recreation use is maintained if the fecal coliform bacteria standard is met for greater than 90% of the samples analyzed. The task is to determine whether the DO, pH, temperature, and fecal coliform bacteria records indicate that the uses are met. If the uses do not appear to be met, they are

either unconfirmed and listed as threatened or confirmed and listed as impaired.

Initially, each datum for the variables is compared against the regulatory standard. If the standard is exceeded, a violation has occurred. Because environmental conditions vary, it is possible for a violation to occur without signaling a significant environmental change. As Ward and Loftis (1983) quote from Roberts, "one cannot ensure that a reasonable standard will never be violated". Consequently, while some measurements might violate water quality standards, a low violation rate is an insufficient reason to classify a stream as failing its designated use. The tool used by DEQ to differentiate degrees of potential impairment for this reporting period is the Binomial Assessment Method instead of the EPA Fixed Rate Assessment Method.

The EPA Fixed Rate Assessment Method:

EPA has proposed an assessment method for the 305(b) report based on assumptions about the kind and frequency of data needed to support such an assessment. The object is to indicate whether waters are fully, partially, or non supporting for the designated uses. EPA has proposed two thresholds for this purpose, a 10% and a 25% violation rate for a conventional pollutant. These percentages are fixed. Table 3.2-3 summarizes the EPA fixed rate assessment parameters.

Table 3.2-3. EPA fixed rate assessment parameters

Violation Rate of Total Samples Analyzed	Assessment
$\leq 10\%$	meets use
$10\% < \text{rate} < 25\%$	partially meets use
$\geq 25\%$	fails to meet use

The need for a different statistical approach in Virginia, results from this fixed rate method and its assumptions. The primary concern associated with this method stems from the thresholds being predicated on monthly data. DEQ water quality data are often collected quarterly. DEQ has been encouraged to spread its monitoring efforts over more of the State's waters. To achieve this with a fixed monitoring budget, the average collection frequency changed from monthly to quarterly in 1994. The benefit from this change is more streams and more stream miles can be assessed. The disadvantage is the data collected from each station are fewer. The data set has become wide geographically but shallow in frequency. Consequently, when the biennial assessments are based on two years worth of data, quarterly sampling only generates 8 samples at most over the period. Thus, the data base for assessment is a third of what is expected using the fixed rate method.

A second concern with applying the fixed rate method is that DEQ's monitoring program is diverse. Sampling costs and program intentions generate different monitoring schemes. These differing schemes generate different sized data sets. For example, quarterly ambient monitoring produces 8 data points in a biennium while biomonitoring is semi annual and produces 4 data points in the same period. This variable sample size violates the assumption of constant data records between sampling stations.

Third concern, the routine loss of data and the annual modification of the sampling network exacerbate the sample size problem by increasing the number of possible data set sizes.

Impacts of the 5 Year Period:

The move to include up to 5 years in the 305(b) assessment period does not invalidate the interpretation problems mentioned above. The data sets will be on average 2.5 times larger but the variation in sample size will remain. The difficulty of applying fixed yardsticks to unequal sized data sets will still persist.

Binomial Assessment Method:

The method considers violations as successes in a statistical binomial population and uses the likelihood of the violations in light of two possible population violation rates, 10% and 25%. A pair of hypotheses are established for each violation rate and the chance computed of the sample coming from a population with the specified violation rate. If the sample is statistically likely to have a violation rate of 10% or less, the waters from which the sample is taken are considered suitable for the use. If the sample is statistically likely to have come from a population with a violation rate between 11% and 25%, the waters are classified partially suitable for the use. Finally, if the sample is likely to have come from a population with a violation rate in excess of 25%, the waters are considered to fail the designated use. The error rates are published in the 305(b) report in Appendix B, along with the assessment statement. The statistical conclusion of supporting, partially supporting, or failing the aquatic life/swimmable use is recorded in the Virginia Waterbody System database which is sent to EPA.

The Hypotheses:

Given environmental variability, and given that conventional pollutants in most Virginia streams meet the standards, it is reasonable to hypothesize that waters are clean unless proven polluted. As in a law court, the subject is innocent until proven guilty. The hypotheses that DEQ uses to make assessments of conventional pollutant data follow this pattern. For a conventional water quality variable, DEQ hypothesizes that one of the following is true.

H₀: The water quality variable exceeds the state standard ≤ 0.10 of the time.

H_a: The water quality variable exceeds the state standard > 0.10 of the time.

Based on a sufficiently large sample, if we fail to find a high enough violation rate to reject H₀, we agree that the waters meet the 10% threshold. As discussed later, the sample size must exceed 13 to be considered statistically sufficient to apply the hypothesis test.

Evaluating the Hypotheses:

The binomial distribution is used to determine which hypothesis is likely to be true. The population is assumed to have a violation rate of 0.10. A sample size of **n** with **x** violations are observed. For a monitoring station, record the probability of obtaining **x** violations or more based on the sample size. The chance of making a Type I error (alpha, α) for violation rate is set at 10%. Then, if the probability of the number of violations is greater than 10%, we accept H₀ and say that the represented waters meet the regulatory use implied by the variable. If not, we say the waters do not meet the use; we accept H_a. For example, if the fecal coliform violation rate at a monitoring station is 2 out of 8, the probability of that high or higher violation rate, based on the binomial distribution, is 18.69%. Therefore, the waters would meet the swimming use. However, if the violation rate was 3 out of 8, the chance of getting that high a violation rate or higher is only 3.81%, well below the rate of 10%. In this case, the waters would not meet the swimming use.

If a violation record does not meet a use based on the first pair of hypotheses, it is further

evaluated to differentiate whether the not meeting use is partial or full. For this purpose a second set of hypotheses are constructed.

H_0 : The water quality variable exceeds the state standard ≤ 0.25 of the time.

H_a : The water quality variable exceeds the state standard > 0.25 of the time.

Based on a sufficiently large sample, if we fail to find a high enough violation rate to reject H_0 , we agree that the waters meet the 25% threshold. Because the waters did not meet the first H_0 of $\leq 10\%$ but met the second H_0 of $\leq 25\%$, they are classified as partially meeting the designated use. However, if the violation rate leads us to reject the H_0 of $\leq 25\%$ and accept H_a of $> 25\%$, then the waters are classified as failing to meet the use. This concludes the evaluation of the sample data. Table 3.2-4 summarizes the complete evaluation process.

Table 3.2-4. Assessment of violation record for a monitoring station.

First set of Hypotheses assuming $p=0.1$	Second set of Hypotheses assuming $p=0.25$	Conclusion
H_0 true	H_0 true	waters meet use
H_0 false	H_0 true	waters partially meet use
H_0 false	H_0 false	waters fail to meet use

Rules for Using the Binomial Method in the 305(b)/303(d):

At the outset, it is important to state that any rule can be modified based on **best professional judgement**. The data may indicate a specific assessment is warranted but the assessor may have other information that would lead to a modification or change of the assessment. Table 3.2-5 is the guide for assessing waters in terms of aquatic life use and in terms of swimming use in the 305(b) Report. Note that samples smaller than 13 require special assessment compared to samples larger than 13. An $n=13$ is chosen as the definition of substantial data set because for $n \geq 13$, needing regulatory action is $< 60\%$. The next cutoff of $n \geq 21$ has needing regulatory action $< 40\%$. The final cutoff $n \geq 50$ the needing regulatory action is equal to or less than too much regulatory action taken. Also, the assessment leads to a monitoring action that indicates when sampling should be continued or increased in frequency and when it can be discontinued.

Table 3.2-5. Assessment guide for the 305(b) Report.

n	observed violation rate (r)	P(Over Esti- mation)	P(Under Esti- mation)	Assessment	Sampling Action
< 13	0 0 < r < 10% bin. > 10% bin. > 25% bin.	n.a. n.a. $\leq 10\%$ $\leq 10\%$	> 45% > 45% n.a. n.a.	reserve judg. reserve judg. threatened threatened	increase F. until > 20,reev. continue until > 20,reeval. continue until > 20,reeval. continue until

					> 20,reeval.
13 - 20	0 < r < fix 10% fix10% < r < 10% bin 10%bin < r < 25%bin > 25%bin.	n.a. n.a. ≤ 10% ≤ 10%	< < 60% < 60% n.a. n.a.	unimpaired threatened partial impaired fully impaired	increase F. until > 20,reev. continue until > 20,reeval. continue until > 20,reeval. continue until > 20,reeval.
21 - 49	0 0 < r < 10% bin 10%bin < r < 25%bin > 25%binl	n.a. n.a. ≤ 10% ≤ 10%	< < 40% < 40% n.a. n.a.	unimpaired unimpaired partial impaired fully impaired	may discontinue continue until > 49,reeval. continue, reevaluate continue, reevaluate
> 49	0 0 < r < 10% bin 10%bin < r < 25%bin > 25%bin	n.a. n.a. ≤ 10% ≤ 10%	< < 10% < 10% n.a. n.a.	unimpaired unimpaired partial impaired fully impaired	may discontinue may discontinue continue, reevaluate continue, reevaluate

notes: reserve judg. .. reserve judgement until more data are collected.
 F .. sampling frequency
 reev. .. reevaluate
 n.a. .. not applicable
 fix10% .. the fixed violation rate obtained by (x/n)*100%.
 10%bin .. the 10% threshold calculated by the binomial method.
 25%bin .. the 25% threshold calculated by the binomial method.
 partial impaired .. only partially meets the regulated use
 fully impaired .. does not meet the regulated use.

Additional guidance concerning water quality assessment methodology is contained in the
 draft DEQ WATER QUALITY ASSESSMENT GUIDANCE MANUAL for 305(b) Water Quality report and
 303(d) TMDL Priority List report.

Chapter 3.3 WATER QUALITY ASSESSMENT SUMMARY

Statewide summaries of the river miles, estuarine square miles, and coastal linear miles within and bordering Virginia that fully support, partially support, or do not support the overall designated uses for each waterbody are presented in Tables 3.3-2, 3.3-3, 3.3-4 and 3.3-5. Support of the overall uses for each waterbody was determined by examining the support of the five uses. (i.e., aquatic life, fish consumption, shellfishing, swimming, and drinking water). Overall use support for each waterbody was determined by taking the lowest ranking use category which was not fully supporting for the largest size. Example: A five square mile waterbody which was "not supporting" for 2 square miles for swimming and also "partially supporting" for 5 square miles for aquatic life would still have an overall use support of 2 square miles "not supporting" because "not supporting" is a lower ranking than "partially supporting."

As in previous 305(b) reports, conventional pollutant data continued to make up the bulk of water quality assessments. Samples for conventional pollutants were collected at DEQ's ambient monitoring stations and compared to Virginia's water quality standards. Rather than calculating absolute percent violations, DEQ used the binomial procedure described in "The Assessment of Low Frequency Data in Water Quality Management," to determine the degree of use support. The assessment should be objective except where professional judgement indicates that natural causes are responsible for the violations (or the data are suspect). Waters not meeting standards due to natural conditions are listed as impaired but will not be included in the TMDL development list. For Dissolved Oxygen (DO), the instantaneous minimum standard was used to assess exceedences. The degree of use support was determined as follows:

- Fully supporting - for any one of these parameters, Virginia water quality standard is statistically shown to be exceeded in \leq 10% of the measurements taken over the reporting period.
- Partially supporting - for any one of these parameters, Virginia water quality standard is statistically shown to be exceeded in > 10% to 25% of the measurements taken over the reporting period.
- Not supporting - for any one of these parameters, Virginia water quality standard is statistically shown to be exceeded in > 25% of the measurements taken over the reporting period.

Table 3.3-1 Virginia Water Quality Standards for Dissolved Oxygen, pH, and Maximum Temperature (VR680-21-01.5)

Class of Waters	Description	Dissolved Oxygen (mg/l)		pH(su)	Maximum Temperature (C°)
		Min.	Daily Avg.		
I	Open Ocean	5.0	--	6.0-9.0	--
II	Estuarine Waters	4.0	5.0	6.0-9.0	--
III	Non-Tidal Waters	4.0	5.0	6.0-9.0	32
IV	Mountainous Zone Waters	4.0	5.0	6.0-9.0	31
V	Put & Take Trout Waters	5.0	6.0	6.0-9.0	21

VI	Natural Trout Waters	6.0	7.0	6.0-9.0	20
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Table 3.3-2 provides a summary of all waters assessed (monitored and evaluated). Assessment coverage of rivers and streams was calculated at approximately 19,260 miles. At first glance, this appears to be a decrease from the previous reporting period. However, this apparent decrease is due to the geographical reindexing of the federal waterbody system and additional EPA and DEQ stream mile delineation guidance. The stream mile delineation guidance has provided consistent guidelines for associating the mileage assessed relative to a specific sampling station. This is especially important where there are no easily identifiable changes in watershed characteristics. In most cases, the stream miles associated with a sampling station have been conservatively reduced from previous assessment reports. Therefore, as a result, the total miles assessed have been reduced do to the fact that many sampling stations "associated" upstream and downstream mileage has been reduced . One other important aspect of the mileage delineation for this report has to do with the fact that the way the current mileages were calculated are only reflective of the assessment period from the last (1996) report and not the entire five year assessment period. In other words, the delineation method has changed since the 1996 report and the monitored mileages found in this report only reflect this current two year (1996-98) report cycle and should not be compared to the monitored mileages in previous reports.

Assessment of estuarine waters covered approximately 2,418 square miles of tidal estuaries. Coverage of coastal shore miles remained at 120 linear shore miles. An increased effort to assess the 104 most significant public lakes was accomplished. A total of 140,080 acres were assessed. Table 3.3-3 summarizes the assessments of Virginia's waters for support of aquatic life, fish consumption, shellfish, swimming and drinking water goals. Table 3.3-4 lists the causes and degree of impact for waters resulting in less than full support of the Clean Water Act goals and state water quality standards. All coastal shore waters were evaluated to be fully supporting the fishable and swimmable goals, therefore no causes of less than full support have been identified for these waters.

A major impact of causes and sources is defined as that which causes a significant impairment to the waterbody. Normally, a major impact would be from a sole source or a large contributor and would cause the waters to be not supporting. Moderate and minor impacts have a slight to moderate effect on the waters and may be from a single moderate contributor or a combination of several minor contributors and would generally cause the waters to be considered partially supporting.

As previously stated, the causes and sources of use impairment of Virginia's waters, resulting in less than full support of Clean Water Act goals, are summarized in Tables 3.3-4 and 3.3-5. It is apparent, municipal point sources and agricultural nonpoint sources are primary contributors of use impairment and major impacts. Equally apparent, the primary pollutants causing use impairment are low dissolved oxygen from nutrient enrichment and pathogen indicators. It is important to point out that the impaired waters affected by VDH fish consumption advisories for kepone in the lower James River and mercury in the South and North Fork Shenandoah River will not be included in the 303(d) impaired waters list for TMDL development. EPA and Virginia have agreed to take no additional remedial action for removing the contaminants from these waters. Dredging these waters to remove the contaminants is considered more environmentally damaging than allowing the natural degradation process diminish any potential health impacts.

Finally, another area of concern which is just beginning to be documented is the impact from urban runoff, especially storm sewer overflow drains. These nonpoint source impacts will need to be addressed as Total Maximum Daily Load (TMDL) allocations are developed for the impaired waters .

TABLE 3.3 - 2 - SUMMARY of ASSESSED WATERS

Degree of Use Support	Type	Assessment Category		Total Assessed Size
		Evaluated	Monitored	
Size Fully Supporting All Assessed Uses	E	39.34	583.17	622.51
	R	903.38	7683.87	8587.25
	L	1810.37	130,187.55	131997.92
Size Fully Supporting All Assessed Uses but Threatened for at Least One Use	E	0.08	1358.68	1358.76
	R	897.92	7164.03	8061.95
	L	0	77,342	77,342
Size Impaired for One or More Uses	E	1.83	435.00	436.83
	R	5.49	2605.18	2610.67
	L	0	0	0
Total Assessed	E	41.25	2376.85	2418.1
	R	1,806.79	17453.08	19259.87
	L	1,810.37	138,269.75	140,080.12

L = Lake - acres
E = Estuary - square miles
R = River - miles

TABLE 3.3 - 3 - WATERBODY INDIVIDUAL USE SUPPORT SUMMARY TABLE

Total Size Assessed:
Rivers - 19,260 miles
Lakes - 140,080 acres
Estuaries - 2,418 mi²

Waterbody Size
Rivers - 49,358 miles
Lakes - 149,982 acres
Estuaries - 2,451 mi²

Use	WaterBody Type	Size Fully Supporting	Size Fully Supporting but Threatened	TOTAL SIZE SUPPORTING	Size Partially Supporting	Size Not Supporting	TOTAL SIZE IMPAIRED	Size Not Assessed	TOTAL WATERBODY SIZE
Aquatic Life	River	8,736	10,455	19191	1021	394	1415	28752	49,358
	Lake	131,997	8,082	140079	0	0	0	9903	149,982
	Estuary	173	1965	2138	237	65	302	11	2,451
Fish Consumption	River	48,911	44	48955	189	80	269	134	49,358
	Lake	70,794	69,268	140062	0	0	0	9920	149,982
	Estuary	2,213	239	2452	0	0	0	-1	2,451
Shellfishing	River	*	*	0	*	*	0	49358	49,358
	Lake	*	*	0	*	*	0	149982	149,982
	Estuary	2,073	3	2076	116	24	140	235	2,451
Swimming	River	5,742	1,115	6857	876	559	1435	41066	49,358
	Lake	139,759	0	139759	0	0	0	10223	149,982
	Estuary	2,281	9	2290	16	3	19	142	2,451
Drinking Water	River	2,870	5	2875	5	0	5	46478	49,358
	Lake	103,245	0	103245	0	0	0	46737	149,982
	Estuary	2	*	2	*	*	0	2449	2,451
Administrative	River	0	8,995	8995	0	0	0	40363	49,358
(DCR/Nutrient Enriched)	Lake	0	0	0	0	0	0	149982	149,982

	Estuary	0	0	0	0	0	0	2451	2,451
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*Categories not assessed

TABLE 3.3 - 4 SIZE OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN VIRGINIA

Pollutant	Type	Major Impact	Moderate/ Minor Impact
General Standards (Benthics)	River (mi)	55.86	254.50
	Lakes (acres)	0	0
	Estuary (mi ²)	0	1.21
Non Priority Organics	River (mi)	0	23.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Priority Organics (TBT)	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	13.20
PCB	River (mi)	0	97.57
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Metals	River (mi)	85.89	142.10
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.08
pH	River (mi)	222.52	193.87
	Lakes (acres)	0	0
	Estuary (mi ²)	0	5.23
Siltation	River (mi)	42.64	197.90
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Organic Enrichment/Low D.O.	River (mi)	265.12	374.12
	Lakes (acres)	0	0
	Estuary (mi ²)	64.51	218.42
Thermal Modification	River (mi)	0	92.48
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Pathogen Indicators	River (mi)	543.05	856.82
	Lakes (acres)	0	0
	Estuary (mi ²)	33.82	124.44
Habitat Alterations	River (mi)	0	77.16
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Suspended Solids	River (mi)	1.70	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

TABLE 3.3 - 5 - SIZE OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN VIRGINIA

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
Industrial Point Sources	River (mi)	4.60	22.10
	Lakes (acres)	0	0
	Estuary (mi ²)	0.50	0
Municipal Point Sources	River (mi)	17.48	64.28
	Lakes (acres)	0	0
	Estuary (mi ²)	0.50	0
Combined Sewer Overflow	River (mi)	29.03	33.62
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Collection System Failure	River (mi)	2.84	21.12
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Agriculture	River (mi)	288.64	553.42
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0.01
Grazing Related Sources	River (mi)	0	37.23
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Silviculture	River (mi)	0	10.97
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Urban Runoff/Storm Sewers	River (mi)	131.48	209.74
	Lakes (acres)	0	0
	Estuary (mi ²)	2.40	10.09
Resource Extraction	River (mi)	39.06	105.97
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Land Disposal	River (mi)	71.50	23.75
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Hydromodification	River (mi)	9.46	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Debris/Bottom Deposits	River (mi)	0	1.00
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Habitat Modification	River (mi)	7.28	18.35
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
Natural Sources	River (mi)	241.61	290.46
	Lakes (acres)	0	0
	Estuary (mi ²)	64.41	150.28
Source Unknown	River (mi)	117.98	441.33

Source of Impairment	Type	Major Impact	Moderate/ Minor Impact
VDH Shellfish Condemnation	Lakes (acres)	0	0
	Estuary (mi ²)	0.58	5.13
	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	23.75	116.10
Commercial Port Authority	River (mi)	0	0
	Lakes (acres)	0	0
	Estuary (mi ²)	0	13.20
Other Point Source/Nonpoint	River (mi)	0.74	32.30
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0
VDH Fish Consumption Advisory	River (mi)	80.40	145.18
	Lakes (acres)	0	0
	Estuary (mi ²)	0	0

Chapter 3.4 NONPOINT SOURCE ASSESSMENT

This chapter of the Virginia Water Quality Assessment 305(b) Report provides a watershed assessment of nonpoint source (NPS) pollution potential. The NPS pollution watershed assessment was prepared by the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation (DCR-DSWC). It provides a comparative evaluation of the state's waters, on a watershed basis, to assist in targeting NPS pollution protection activities. More specifically, it assesses NPS pollution potential on a watershed basis.

This NPS assessment summarizes information from the Virginia Department of Conservation and Recreation, Virginia Department of Environmental Quality, Virginia Department of Forestry (DOF), U.S. Department of Agriculture - Natural Resources Conservation Service, Cooperative Extension Service (CES), local Soil and Water Conservation Districts (SWCDs), local governments, and other existing sources of information concerning nonpoint source impacts to Virginia waters. As well, it includes information regarding rare, threatened, and endangered species provided by the Department of Conservation and Recreation, Division of Natural Heritage (DCR, DNH). This information will help program managers better target limited resources and funding.

Statewide Nonpoint Source Pollution Watershed Assessment Methodology

The nonpoint source pollution assessment was developed primarily from inventory data related to specific land use, animal density, and other related factors which have been developed in a uniform manner for all watersheds. This inventory data has been used to develop nonpoint source pollution priorities for the watersheds in Virginia. The following sections discuss and present inventory data and the methodology which was utilized to develop nonpoint source priorities within Virginia.

Inventory Data

Inventory data collected on a hydrologic unit basis were used to rank the watersheds for their potential for NPS pollution based on characteristics such as land use, animal densities and other related data. Data were collected to address the NPS potential from three major land use categories: agricultural, urban, and forestry.

Inventory data were initially collected at the county level from various sources, and then disaggregated to the watershed level. The following data sources were used to obtain county level inventory data: 1992 Census of Agriculture (U.S. Department of Commerce, 1989), 1990 National Survey of Conservation Tillage Practices (Conservation Technology Information Center, 1990), 1992 Natural Resources Inventory (Natural Resources Conservation Service), and the 1991 Hydrologic Unit Database (Department of Conservation and Recreation). Livestock and poultry inventories, land use, and erosion rates were estimated from the above mentioned sources.

To disaggregate the county data to individual watershed areas, questionnaires were created for each county to be completed by DCR, NRCS, SWCD, USDA Farm Service Agency (FSA), CES, DOF and other field personnel. Utilizing county level watershed maps, the field personnel distributed county-level information on land use, livestock and poultry inventories, and erosion rates amongst the watershed units.

Adjustments to county level data based on local knowledge were also performed. The resulting level of detail allowed for grouping data for analysis and ranking by watershed unit as well as by jurisdiction. Table 3.4-1 shows the types of data which were collected for each watershed unit using the questionnaire.

Table 3.4-1 Data Collected by Watershed Using Questionnaire

A. Land use (areal extent in each category)

1. Cropland

- I. Crop
 - ii. Hay
 - iii. Orchard
 - iv. Idle
 - v. NRCS Set-Aside
 - vi. Conservation Reserve Program
- 2. Pasture
- 3. Forest
- 4. Urban or built-up
 - I. Residential
 - ii. Industrial/commercial
 - iii. Other urban
- 5. Water

B. Livestock and Poultry (inventory)

- 1. Beef cattle
- 2. Milk cattle
- 3. Hogs/pigs
- 4. Sheep/lambs
- 5. Chickens
- 6. Broilers
- 7. Turkeys
- 8. Other (horses, fallow deer, etc.)

C. Erosion Information (areal extent in each category)

- 1. Crop
 - I. $< T$ *
 - ii. $T-2T$
 - iii. $> 2T$
- 2. Pasture
 - I. $< T$
 - ii. $T-2T$
 - iii. $> 2T$

* "T" refers to soil-loss tolerance or maximum allowable soil loss.

The Department of Conservation and Recreation, in conjunction with local units of government, also provided information concerning disturbed land for regulated erosion and sediment (E&S) control projects. This data was used to estimate sediment loads from urban development activities.

In addition, the Virginia Department of Forestry provided information on forestry harvesting and reforestation activities across the state. DOF estimates included data on acreages of forest harvesting, site preparation and reforestation. These data were used in conjunction with erosion rate data to estimate erosion from forest harvesting and site preparation. The results of this data are discussed later in this chapter.

A discussion of each aspect of the inventory data collected, the analysis performed, and statewide assessment of the data is discussed individually within the following sections.

Agriculture NPS Pollution Potential

Agriculture is a large and diverse industry in Virginia and accounts for approximately thirty

percent of Virginia's land use. While this percentage is significantly lower than the national average, agricultural activities constitute a significant source of nonpoint source pollution in the state.

Nonpoint source contamination from agriculture originates from several different sources with different associated impacts. The following sections provide a comparative statewide assessment and prioritization of three agriculturally related types of NPS contamination. These types of NPS contamination include: 1) nutrient loads from agricultural crop, pasture and hay lands; 2) nutrients from agriculturally produced animals; and, 3) erosion from agricultural cropland and pasture land. The statewide assessment and prioritization analyzes pollution potential from these types of agricultural activities. The 1998 assessment also takes into consideration NPS controls implemented through the Virginia Agricultural Best Management Practices Cost-Share Program and nutrient reductions that resulted from the Virginia Nutrient Management Program. These programs are administered by DCR. The inclusion of these NPS control activities in the assessment is a revision from the 1996 NPS Assessment.

Virginia's 1998 Agricultural Land Nutrient Load (AGLL) Priorities

AGLL priorities were developed using nutrients estimated from loading factors. Table 3.4-2 shows the nutrient loading factors applied to the land use acreage within each watershed. For each agricultural land use in the watershed, the acreage was multiplied by the corresponding loading factor to estimate yearly loads of nitrogen and phosphorus.

Table 3.4-2 Land Use Loading Factors

	Phosphorus kg/ha/yr (lb/ac/yr)	Nitrogen kg/ha/yr (lb/ac/yr)
1. Cropland		
crop	2.20 (1.96)	9.0 (8.0)
hay	0.85 (0.76)	5.0 (4.5)
orchard	0.75 (0.67)	2.5 (2.2)
idle land	0.75 (0.67)	2.5 (2.2)
FSA set-aside	0.75 (0.67)	2.5 (2.2)
CRP	0.75 (0.67)	2.5 (2.2)
2. Pasture	0.85 (0.76)	5.0 (4.5)
3. Forest	0.20 (0.18)	2.5 (2.2)
4. Urban or built-up		
residential	1.10 (0.98)	5.0 (4.5)
industrial/commercial	2.60 (2.32)	11.0 (9.0)
other urban	0.60 (0.54)	4.0 (3.6)
5. Water	0.00 (0.00)	0.0 (0.0)

Source: Beaulac and Reckhow (1982)

The nitrogen and phosphorus loads from the loading factors were summed to determine a yearly agricultural land nutrient load for each watershed. The per acre nutrient load was then calculated by dividing this nutrient load by the land area in each watershed. Finally, AGLL was computed for each watershed by normalizing the computed unit loads utilizing the average nutrient load value of all the watersheds and the standard deviation of the nutrient load values. This procedure was performed so that this indicator could be compared to normalized rankings for other pollution indicators.

Figure 3.4-1 displays the watersheds prioritized for agricultural land nutrient loadings.

Virginia's 1998 Animal Nutrient Load Priorities (AL)

AL priorities were developed using estimated nutrient loads produced by livestock and poultry. Nutrients produced each year by livestock and poultry were estimated by multiplying numbers of each animal type by an appropriate waste generation factor. The waste generation factors are based on average annual manure production and manure nutrient content for each animal type.

Table 3.4-3 shows the nutrient loading factors applied to the animal waste within each watershed.

Table 3.4-3 Animal Waste Loading Factors

	Phosphorus	Nitrogen
	<u>kg/yr/animal (lb/yr/animal)</u>	<u>kg/yr/animal (lb/yr/animal)</u>
1. Beef cattle	15.11 (33.32)	84.81 (187.1)
2. Milk cattle	18.20 (40.15)	56.26 (124.1)
3. Hogs/pigs	(1/2) 0.81 (1.79)	2.40 (5.3)
	(1/2) 2.48 (5.48)	7.43 (16.4)
4. Sheep/lambs	1.09 (2.41)	7.43 (16.4)
5. Chickens	0.18 (0.40)	0.5 (1.1)
6. Broilers	0.09 (0.20)	0.41 (0.9)
7. Turkeys	0.44 (0.98)	1.99 (4.4)
8. Other		
horses	7.61 (16.79)	44.70 (98.6)
fallow deer	1.09 (2.41)	7.43 (16.4)

Source: Midwest Plan Service (1983) and American Society of Agricultural Engineers (1983)

Nitrogen and phosphorus estimates within each watershed were summed for all animals to determine an estimated yearly animal load. The unit load was then calculated by dividing this nutrient load by the land area in each watershed. Finally, AL was computed for each watershed by normalizing the computed unit loads utilizing the average animal nutrient load value of all watersheds and the standard deviation of the animal nutrient load values.

Figure 3.4-2 displays the animal nutrient load priorities by watershed statewide.

Virginia's 1998 Agricultural Erosion Priorities (AGER)

AGER priorities were evaluated using estimated erosion from agricultural land only. Potential annual erosion rates were estimated using erosion information from the questionnaires previously discussed and the Virginia 1982 National Resource Inventory (NRI) (NRCS, 1992). The questionnaires provided erosion information as amounts of cropland and pasture eroding at pre-defined ranges. These ranges were based on soil-loss tolerance or maximum allowable soil loss ("T" values). The acreage within each watershed was distributed amongst three erosion rate categories: less than "T", between "T" and "2T", and greater than "2T". Appropriate erosion rates were developed from the 1987 NRI based on the erosion ranges and acreage.

Estimated soil loss from the agricultural land categories was summed to estimate an agricultural erosion load for each hydrologic unit. A unit load was then calculated by dividing this erosion load by the land area in each watershed. Finally, the agricultural erosion load was normalized utilizing the average erosion rate for of all watersheds and the standard deviation of the erosion rates.

Figure 3.4-3 displays the watersheds with the priority areas for agricultural erosion potential.

Virginia's 1998 Total Agricultural NPS Pollution Priorities (AGTOT)

AGTOT priorities were computed for each watershed based on the three components discussed above. Agricultural land load (AGLL) assesses potential nutrients in runoff from crop, pasture, and hay land. Animal Nutrient Load Priorities (AL) account for nutrient contributions from livestock and poultry. Agricultural Erosion Priorities (AGER) ranks watersheds based on potential erosion occurring on agricultural land. The AGTOT for each watershed was computed as follows:

$$AGTOT_i = AGLL_i + AL_i + AGER_i$$

In the above equation, *i* represents the watershed of interest.

Figure 3.4-4 presents the total agricultural NPS pollution priorities statewide, which represents each watershed's relative significance in contributing to agricultural NPS pollution throughout the state. Watersheds with the higher priorities are the greatest priority for targeting agricultural conservation programs.

Urban NPS Pollution Potential

Urbanization of forest and agricultural land is occurring at a rapid rate in many parts of Virginia. This urbanization results in increased NPS pollution as the result of precipitation washing nutrients, sediment, and other toxic substances from the impervious surfaces which make up these areas. The sources of these surface contaminants include: air and rain deposition of atmospheric pollution; littered and dirty streets; traffic by-products such as petroleum residues, exhaust products, heavy metals and tar residuals from the roads; chemicals applied for fertilization, control of ice, rodents and other pests; and sediment from construction sites. Illegal industrial, commercial and domestic hook-ups to storm sewers also contribute a number of specific pollutants to water courses, as do inadequate sewage disposal systems both for municipalities and individual homes.

The following sections provide a comparative statewide assessment and prioritization of two urban related types of NPS pollution. These include nutrient loads from urban areas and erosion from urban lands and construction sites. The statewide assessment does not directly account for many of the other contaminants coming from urban lands; however, the weight of the urban priorities in the overall NPS pollution priorities has been increased in an attempt to compensate for these problems.

Virginia's 1998 Urban Nutrient Load Priorities (UNUT)

UNUT priorities were developed using nutrients estimated from loading factors. Table 3.4-2 shows the loading factors applied to the different urban land uses within each watershed. As previously stated, the acreage of each urban land use in the watershed was multiplied by the corresponding loading factor to estimate yearly loads of nitrogen and phosphorus available for NPS pollution.

The calculated nitrogen and phosphorus loads from loading factors were summed to determine a yearly urban nutrient load for each hydrologic unit. Unit loads were then calculated by dividing this nutrient load by the land area in each watershed. Finally, UNUT were computed for each watershed by normalizing the computed unit loads utilizing the average nutrient load value of all watersheds and the standard deviation of the nutrient load values. This procedure was performed so that the two urban indices would be comparable in value.

Figure 3.4-5 displays the watersheds statewide for urban land nutrient loading priorities. The priorities generally identify the major urban areas within Virginia and reflect the general urbanized area

of Tidewater Virginia as compared to the remainder of the state.

Virginia's 1998 Urban Erosion Priorities (UERO)

UERO priorities were developed by estimating urban erosion rates from disturbed and undisturbed urban lands. Disturbed urban areas were estimated by DCR erosion and sediment control field personnel in consultation with local government staff for each watershed by estimating the amount of urban land which was disturbed. This estimate is based primarily on land which is under development and regulated by the Virginia Erosion and Sediment Control Law (Title 10.1, Chapter 5, Article 4, Section 10.1-560 of the Code of Virginia). All other urban lands identified within the watershed were considered undisturbed. An erosion rate of 45 tons/acre was then utilized for disturbed land and .6 tons/acre for undisturbed land. An Urban erosion load was then calculated for each watershed by summing the calculated urban soil loss loads for disturbed and undisturbed land and then dividing this total load by the land area within each watershed to get the unit load for each watershed. The unit loads were then normalized utilizing the average urban erosion rate of all watersheds and the standard deviation of the erosion rates.

Figure 3.4-6 displays the watershed priorities for urban erosion statewide. The priorities are reflective of the areas of Virginia which are undergoing the most significant urban development activity. It is important to keep in mind that these priorities are based on pollution potential and do not compensate for control measures that may be in place in some areas.

Virginia's 1998 Total Urban Pollution NPS Priorities (UTOT)

UTOT priorities are indicated on Figure 3.4-7. These priorities reflect the relative potential significance of each watershed in contributing to urban NPS pollution on a comparative statewide basis. The total urban pollution priority was developed for each watershed based on two components: the urban land nutrient priorities and the urban erosion priorities. The erosion portion of these priorities includes separate erosion estimates for disturbed and undisturbed urban land.

Figure 3.4-7 indicates, as expected, that the highest priority urban areas are those portions of the state already containing substantial developed areas or that are currently urbanizing.

Forestry Nonpoint Source Pollution Priorities

The Virginia Department of Forestry (DOF) has begun tracking numerous activities of the forest industry to facilitate the proper management of Virginia's forest resources relative to water quality. Among these activities are the recording of forest harvesting, site preparation, and reforestation acres on a watershed and county basis. This information, in conjunction with other scientific data, provides a management tool for targeting and evaluating the NPS pollution potential on a statewide basis and serves as the principal component of the forestry NPS assessment information.

The following maps and analysis attempt to quantify soil erosion from timber harvesting and site preparation activities. These activities may contribute to increases in sedimentation of the state's water courses and potential physical and biological impacts if proper management does not occur. Data on forestry activities were developed by DOF foresters. The maps depict the relative level of forest activity on a per acre basis of land within each hydrologic unit for the calendar year 1994 and are reflective of that year's activity only. The analysis and maps make no attempt to account for proper management, or lack thereof, and reflect only the potential for forestry related nonpoint source concerns.

Virginia's 1998 Forestry Harvested Erosion Priorities (FHAR)

FHAR priorities were calculated for each watershed by multiplying the total acres harvested during 1994 by the logging erosion rates for Major Land Resource Areas (MLRAs). MLRAs erosion

rates are listed in Table 3.4-4. The per unit value was then calculated by dividing the result by the total acreage of the watershed. Figure 3.4-8 displays the statewide watershed priorities for forest harvesting activities.

Virginia's 1998 Forestry Site-Prepared Erosion Priorities (FSIT)

FSIT priorities were calculated for each watershed by multiplying the sum of site-prepared acres during 1994 by erosion rates reported in Table 3.4-4 for the MLRAs. A per unit value was then calculated by dividing the result by the total land acreage of the watershed. The priority watersheds for site preparation activities are shown in Figure 3.4-9.

Virginia's 1998 Total Forestry Erosion Priorities (FTOT)

FTOT priorities were calculated by adding the estimates of soil loss due to harvesting and site prepared activities within each watershed. These estimates are added since these forestry operations are separate and distinct. The per unit value was then calculated by dividing the result by the total land acreage of the watershed. The total forestry rankings are depicted in Figure 3.4-10.

The forestry rankings are affected principally by the number of acres subject to a specific forest activity and the erosion rates assigned to the region. In general, more forest harvesting and site preparation occurs in Virginia's Piedmont and coastal areas. However, erosion rates for these areas are much lower than the rates recorded for western portions of the state. The higher western rates tend to cause the rating of forestry areas in the west to be higher than areas in the east with similar activity levels. This pattern is consistent with other non-forestry activities, such as agriculture, and is due largely to topography and the variation of soil types.

It should be noted that only a fraction of all sedimentation in Virginia is caused by timber related activities, and its duration is usually only two or three years following harvest. Most logging related erosion is restricted to either roads and trails used to remove logs from the forest or to land that is being prepared for reforestation.

Table 3.4-4 Erosion Rates on Forest Lands

Forest Activity

MLRA	Logging	Only Burn	Chop/Burn	Dozing	Bull-Chemical
<u>Erosion Rates (lbs./ac./yr.)</u>					
125	0.43	3.6	0.14*	13.7*	0
128	1.75	3.6*	0.14*	13.7	0
130	3.68	3.6*	0.14*	13.7*	0
136	0.48	0.16	0.38	1.9	0
147	1.75•	3.6*	0.14*	13.7*	0
148	0.13	3.6*	0.14	13.7*	0
133A	0.45	0.15	0.36	0.78	0
153A	0.08	0.10	0.15	0.78	0
153B	0.08	0.10	0.15	0.78	0

•No data was reported for MLRA 147; assumed similar to MLRA 128.

*No data was reported. Values assumed based on guidance from Virginia Department of Forestry.

Source: Dissmeyer and Stump, 1978

Virginia's 1998 Overall Nonpoint Source Pollution Priorities

The overall nonpoint source pollution priorities are based on a weighted combination of the total priority results from the agriculture, urban and forestal sources. As discussed within the forestry section above, the relative contribution of forestry sources is considered much less significant than agriculture or urban sources due to the relative potential for nutrient and sediment loading from forestal activities as compared to these other sources. Therefore, the total NPS priority rating weights the forestal source at 5% and the urban and agricultural sources are equally weighted at 47.5% to determine the overall rating value for each watershed. Based on this weighting, Figure 3.4-11 illustrates the overall NPS priority watersheds broken into three categories of high, medium and low. The high priority watersheds reflect the top 20% of the rated watersheds, with the next 30% considered medium priority and the remaining 50% considered low priority. This breakdown of high, medium and low priority watersheds is consistent with Environmental Protection Agency (EPA) recommendations to identify the top 20% of watersheds as high priority. In addition, watersheds in which special projects have been initiated with funds from Section 319 of the Clean Water Act will remain high priority until water quality monitoring as funded through those projects indicates a water quality improvement. This process resulted in 111 high, 140 medium and 243 low priority watersheds.

In general, NPS priorities reflect Virginia's urban and agricultural dominated regions. In particular, the priorities highlight the urbanizing eastern crescent from Northern Virginia to the Hampton Roads area along with other urban centers such as Roanoke and Lynchburg. Agricultural influences due to cropland nutrient use on the Eastern Shore, intensive animal and other associated agricultural activity in the Shenandoah Valley area, and high erosion rates in Southwestern portions of the state are also key factors in the overall prioritization.

These results of the overall priority ranking process are summarized in Table 3.4-5 which list watersheds in alphabetical order within a high, medium, or low priority ranking. Table 3.4-5 also includes a priority ranking of watersheds based on known occurrences of natural heritage resources.

Natural Heritage Resource data was included in the overall priority ranking so that information regarding rare, threatened, and endangered species could be easily cross referenced with overall pollution potential priorities to help determine the relative importance of a given watershed and the need for restoration or protection. The methodology used in determining the watershed priority ranking for natural heritage resources is discussed in a subsequent section of this report.

As discussed, the overall 1998 nonpoint source pollution priorities are influenced mostly by the agricultural and urban information obtained from across the state. The overall rank excludes abandoned mined land data and septic system data, which may have a very important effect on water quality problems on a local or regional basis. For purposes of this report, we have not been able to consolidate available information to characterize these pollution sources by watershed. Efforts are continuing to assess impacts due to these sources.

Many other data sources could be used to further determine the importance of a watershed and the need for protection. Information such as public water supply locations or other specific use requirements of water resources should be incorporated where possible. Thus far, these data have not been used in the statewide rankings.

Natural Heritage Resources Priority Ranking Methodology

For purposes of this report, hydrologic units have been ranked according to the presence of wetland and aquatic natural heritage resources. Natural heritage resources include the habitat of rare, threatened, and endangered plant and animal species and exemplary natural communities. DCR's Division of Natural Heritage (DCR-DNH), responsible for identifying and inventorying Virginia's natural heritage resources, has documented over 7800 occurrences of approximately 1400 rare plants and animals and 220 natural community types. Information about the status and location of these occurrences is used to prioritize and direct conservation activities, and to guide economic

development activities that might impact these resources.

Much of the Commonwealth's biodiversity is directly dependent on the water quality of rivers, streams, wetlands, and groundwater. Virginia's hydrologic units have been prioritized according to their importance for natural heritage resources. These priorities should direct nonpoint source contamination mitigation efforts and other water quality improvement projects toward those watersheds in which natural heritage resources will benefit from the maintenance or enhancement of water quality.

The following procedure was followed to rank the hydrologic units for their significance to natural heritage resources.

- Only natural heritage resources likely to be directly impacted by changes in water quality were included in the assessment. These include aquatic and wetland plants and animals, wetland communities, and subterranean aquatic invertebrates. About 915 species and 34 natural communities are included.
- Natural heritage resource occurrences that have been verified since 1970 and whose locations are known to an accuracy of within 1.5 miles on a 7.5 minute USGS quadrangle are included. The total number of natural heritage resource occurrences considered is 3294, including 245 natural community occurrences. These occurrences are located in 319 of Virginia's 494 hydrologic units.
- A formula was used to assign a score to each hydrologic unit. The factors used to determine this score were the number of natural heritage resource occurrences in the hydrologic unit and the global rarity (Grank) of these natural heritage resources, as established by the Network of National Heritage Programs and Conservation Data Centers. Weighted values were assigned to the global rarity rank of each natural heritage resource according to table 3.4-5.

Table 3.4-5 Global Rarity Ranking

Global Rarity Rank	WEIGHT
G1 (extremely rare and critically imperilled)	10
G2 (very rare and imperilled)	7
G3 (either very rare throughout its range or found in a restricted range)	4
G4 (common and apparently secure globally, though rare in Virginia)	2
G5 (very common and secure globally, though rare in Virginia)	1

These values were then summed for each natural heritage resource occurrence in a hydrologic unit to calculate a final score for the watershed. Scores ranged from 0 (175 hydrologic units with no documented occurrences) to 857 (one hydrologic unit with 156 occurrences).

- The scores were used to aggregate the hydrologic units into three priority classes: high, medium and low priority. A complete listing of natural heritage resource priorities for every hydrologic unit in Virginia is found in Table 3.4-6. Natural heritage resource priorities are also represented on a map of Virginia, Figure 3.4-12. The following table shows the distribution of priorities:

Table 3.4-6 Hydrologic Unit Scoring

PRIORITY	WATERSHED SCORES	NO. OF HYDROLOGIC UNITS

High	31 +	99 (20%)
Medium	6-30	146 (30%)
Low	0-5	249 (50%)

The lack of documented natural heritage resource occurrences does not guarantee that natural heritage resources are not present, because many watersheds have not been adequately inventoried. Consequently a low priority ranking does not necessarily mean that there are no natural heritage resources present in a given watershed. Rather, it could mean that no resources have been recorded because the watershed has not been adequately surveyed. In other words, a low priority ranking could be the result of no data. Information in DCR-DNH's databases is continually added and updated. Project planners are encouraged to contact DCR-DNH for current and detailed information on the status of natural heritage resource occurrences. Table 3.4-7 provides the statewide priority ranking for the Natural Heritage priority ranking and nonpoint source pollution potential priorities

Table 3.4-7 Statewide Nonpoint Source Pollution Potential Priorities with Natural Heritage Priority Ranking

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
A02	CATOCTIN CREEK	High	Low
A03	POTOMAC RIVER/IMFSTONE BRANCH	High	Low
A06	NORTH FORK GOOSE CREEK	High	Medium
A09	POTOMAC RIVER/BROAD RUN	High	Low
A10	SUGARLAND RUN	High	Low
A11	POTOMAC RIVER/DIFFICULT RUN	High	High
A12	POTOMAC RIVER/FOURMILE RUN/PIMMIT RUN	High	Low
A13	CAMERON RUN	High	Low
A14	POTOMAC RIVER/DOGUE CREEK/LITTLE HUNTING CREEK	High	Medium
A15	ACCOTINK CREEK	High	Medium
A16	POHICK CREEK	High	Low
A20	UPPER OCCOQUAN RIVER/LAKE JACKSON	High	Low
A21	UPPER BULL RUN/LITTLE BULL RUN	High	Low
A22	CLUB RUN	High	Low
A23	LOWER BULL RUN/POPPES HEAD CREEK	High	Low
A24	OCCOQUAN RIVER - RESERVOIR	High	Low
A25	POTOMAC RIVER/LOWER OCCOQUAN RIVER/NEABSCO CREEK	High	Medium
A26	POTOMAC RIVER/QUANTICO CREEK/CHOPAWAMSIK CREEK	High	Medium
A27	UPPER AQUIA CREEK/BEAVERDAM RUN	High	Medium
A28	LOWER AQUIA CREEK	High	Low
B01	UPPER NORTH FORK SOUTH BRANCH POTOMAC RIVER/LAUREL	High	High
B10	UPPER MIDDLE RIVER	High	Low
B12	MIDDLE RIVER/IFWIS CREEK	High	Low
B13	MOFFETT CREEK	High	Low
B14	CHRISTIANS CREEK	High	Medium

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
B15	LOWER MIDDLE RIVER	High	Low
B17	MIDDLE NORTH RIVER	High	Low
B18	BRIFRY BRANCH	High	Medium
B19	MOSSY CREEK	High	Low
B21	LOWER DRY RIVER	High	Low
B22	MUDDY CREEK	High	Low
B23	LOWER NORTH RIVER	High	Low
B24	LONG GLADE CREEK	High	Low
B25	COOKS CREEK	High	Low
B26	BLACKS RUN	High	Low
B27	PIFASANT RUN	High	Low
B28	NAKED CREEK	High	Low
B29	MILL CREEK	High	Low
B30	UPPER SOUTH RIVER	High	High
B34	CUB RUN	High	Low
B41	LOWER SOUTH FORK SHENANDOAH RIVER	High	Medium
B45	NORTH FORK SHENANDOAH RIVER/HOLMANS CREEK	High	Low
B46	LINVILLE CREEK	High	Medium
B55	UPPER SHENANDOAH RIVER	High	Low
B57	SHENANDOAH RIVER/SPOUT RUN	High	Medium
C03	PIANKATANK RIVER	High	Medium
C06	CHESAPEAKE BAY/SEVERN RIVER	High	Medium
C07	CHESAPEAKE BAY/BACK RIVER/POOHOSON RIVER	High	High
C08	LYNNHAVEN RIVER/LITTLE CREEK	High	High
C15	CHERRYSTONE INLET/KINGS CREEK	High	Medium
C16	CHESAPEAKE BAY/OLD PLANTATION CREEK	High	Medium
D01	CHINCOTEAGUE BAY/LITTLE MOSQUITO CREEK	High	High
D05	OUTLET BAY/RAMSHORN BAY	High	High
D07	RUDEE INLET	High	Medium
E09	MOUNTAIN RUN	High	Medium
E16	RAPIDAN RIVER/CEDAR RUN	High	Medium
F20	RAPPAHANNOCK RIVER/MASSAPONAX CREEK	High	Low
F23	RAPPAHANNOCK RIVER/CATPOINT CREEK/PISCATAWAY CREEK	High	High
F20	POLECAT CREEK	High	Medium
F27	LOWER YORK RIVER/CARTER CREEK/KING CREEK	High	High
G01	JAMES RIVER/FALLING CREEK/PROCTORS CREEK	High	Medium

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
G05	UPPER CHICKAHOMINY RIVER/LIPHAM BROOK/STONY RUN	High	Low
G10	JAMES RIVER/POWHATAN CREEK/GRAYS CREEK	High	High
G11	JAMES RIVER/PAGEN RIVER/WARWICK RIVER/CHUCKATUCK	High	High
G15	HAMPTON ROADS/ELIZABETH RIVER	High	Medium
H03	JAMES RIVER/BLACKWATER CREEK/IVY CREEK	High	Low
H28	UPPER RIVANNA RIVER/MOORES CREEK	High	Low
H29	MIDDLE RIVANNA RIVER/BUCK ISLAND CREEK	High	Low
H39	JAMES RIVER/TUCKAHOE CREEK/NORWOOD CREEK	High	Medium
I04	JACKSON RIVER/FALLING SPRING CREEK	High	Medium
I18	UPPER JAMES RIVER/SINKING CREEK/MILL CREEK	High	Low
I20	MEADOW CREEK	High	Medium
I33	UPPER MAURY RIVER/KERRS CREEK	High	Medium
I34	HAYS CREEK	High	Low
I35	MIDDLE MAURY RIVER/MILL CREEK	High	Low
J15	LOWER APPOMATTOX RIVER/ASHTON CREEK	High	High
K30	LOWER NOTTOWAY RIVER/MILL CREEK	High	Medium
K40	NORTHWEST RIVER	High	High
L04	ROANOKE RIVER/MASON CREEK	High	Medium
L05	TINKER CREEK/CARVIN CREEK/GLADE CREEK	High	Medium
L09	MAGGODD CREEK	High	Low
L12	LOWER SMITH MOUNTAIN LAKE	High	Low
L26	LITTLE OTTER RIVER/MACHINE CREEK	High	Medium
L49	MATRIMONY CREEK	High	Low
L53	SMITH RIVER/REED CREEK/BEAVER CREEK	High	Low
L54	LOWER SMITH RIVER	High	Low
L58	SANDY RIVER	High	Low
L60	DAN RIVER/CANE CREEK	High	Low
L61	FALL CREEK	High	Low
N05	ELK CREEK	High	Low
N06	NEW RIVER/CHESTNUT CREEK/BRUSH CREEK	High	High
N09	CRIPPLE CREEK	High	Medium
N10	UPPER REED CREEK	High	Low
N13	UPPER BIG REED ISLAND CREEK/LAUREL FORK	High	High
N18	NEW RIVER/CRAB CREEK	High	Medium
N19	EAST FORK LITTLE RIVER	High	High
N21	LITTLE RIVER/INDIAN CREEK/BRUSH CREEK	High	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
O05	LOWER MIDDLE FORK HOLSTON RIVER	High	High
O06	SOUTH HOLSTON LAKE/WOLF CREEK/FIFTEENMILE CREEK	High	Medium
O07	SOUTH FORK HOLSTON RIVER/BEAVER CREEK	High	Low
O10	NORTH FORK HOLSTON RIVER/LAUREL CREEK	High	High
O11	NORTH FORK HOLSTON RIVER/WOLF CREEK/TUMBLING CREEK	High	High
O13	LOWER NORTH FORK HOLSTON RIVER/POSSUM CREEK	High	High
O14	BIG MOCCASIN CREEK	High	Medium
P01	UPPER CINCINNATI RIVER	High	Medium
P05	LITTLE RIVER	High	High
P06	BIG CEDAR CREEK	High	Medium
P07	CINCINNATI RIVER/THOMPSON CREEK	High	High
P14	COPPER CREEK	High	High
P20	NORTH FORK POWELL RIVER	High	Low
O13	POUND RIVER	High	Medium
A01	POTOMAC RIVER/PINEY RUN/DUTCHMAN CREEK	Medium	Medium
A04	UPPER GOOSE CREEK/GAP RUN	Medium	Medium
A05	MIDDLE GOOSE CREEK/PANTHER SKIN CREEK	Medium	Medium
A07	BEAVERDAM CREEK	Medium	Low
A08	LOWER GOOSE CREEK/LITTLE RIVER	Medium	Medium
A17	UPPER CEDAR RUN/LICKING RUN	Medium	Low
A19	BROAD RUN/KETTLE RUN	Medium	Medium
A29	POTOMAC RIVER/POTOMAC CREEK	Medium	Medium
A30	POTOMAC RIVER/UPPER MACHODOC CREEK	Medium	Medium
A31	POTOMAC RIVER/MATTOX CREEK/POPE CREEK/ROSE CREEK	Medium	Medium
A32	POTOMAC RIVER/NOMINI CREEK/LOWER MACHODOC CREEK	Medium	Medium
A34	POTOMAC RIVER/COAN RIVER/LITTLE WICOMICO RIVER	Medium	High
B02	UPPER SOUTH BRANCH POTOMAC RIVER	Medium	Low
B08	UPPER OPEQUON CREEK	Medium	Low
B09	LOWER OPEQUON CREEK	Medium	Medium
B11	MIDDLE RIVER/JENNINGS BRANCH	Medium	Low
B32	LOWER SOUTH RIVER	Medium	High
B40	SOUTH FORK SHENANDOAH RIVER/GOONEY RUN	Medium	Medium
B47	SMITH CREEK	Medium	Medium
B48	NORTH FORK SHENANDOAH RIVER/MILL CREEK	Medium	Low
B49	STONY CREEK	Medium	Low
B50	NORTH FORK SHENANDOAH RIVER/NARROW PASSAGE CREEK	Medium	Medium

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
B53	LOWER CEDAR CREEK	Medium	Low
B56	CROOKED RUN	Medium	Low
C01	CHESAPEAKE BAY/GREAT WICOMICO RIVER	Medium	Low
C04	CHESAPEAKE BAY/EAST RIVER/NORTH RIVER	Medium	High
C05	WARE RIVER	Medium	Low
C09	POCOMOKE RIVER/PITTS CREEK	Medium	Low
C11	CHESAPEAKE BAY/ONANCOCK CREEK	Medium	Medium
C12	PLINGOTFAUGH CREEK	Medium	Low
C13	NANDUA CREEK/OCCOHANNOCK CREEK/NASSAWADOX CREEK	Medium	High
C14	CHESAPEAKE BAY/HUNGARS CREEK	Medium	Medium
D02	ASSAWOMAN CREEK	Medium	Medium
D03	MFTOMKIN BAY/BURTONS BAY	Medium	High
D04	HOG ISLAND BAY/MACHIPONGO RIVER	Medium	High
D06	MAGOTHY BAY/MOCKHORN BAY	Medium	High
E01	UPPER RAPPAHANNOCK RIVER/THUMB RUN/JORDAN RIVER	Medium	Medium
F02	RAPPAHANNOCK RIVER/CARTER RUN/GREAT RUN	Medium	High
E06	LOWER THORNTON RIVER	Medium	Low
E07	LOWER HAZEL RIVER/MUDDY RUN/INDIAN RUN	Medium	Low
E08	RAPPAHANNOCK RIVER/MARSH RUN	Medium	Medium
F13	RAPIDAN RIVER/BELF RUN/BEAUTIFUL RUN	Medium	Medium
E14	UPPER ROBINSON RIVER/WHITE OAK RUN	Medium	High
E15	LOWER ROBINSON RIVER/CROOKED RUN/DEEP RUN	Medium	Low
E17	RAPIDAN RIVER/MINE RUN/MOUNTAIN RUN	Medium	Low
F19	RAPPAHANNOCK RIVER/MOTTS RUN	Medium	Low
E22	RAPPAHANNOCK RIVER/OCCUPACIA CREEK/PEEDEE CREEK	Medium	High
E24	RAPPAHANNOCK RIVER/TOTUSKEY CREEK	Medium	Medium
E26	LOWER RAPPAHANNOCK RIVER/CORROTOMAN RIVER	Medium	High
F01	UPPER SOUTH ANNA RIVER	Medium	Low
F04	LOWER SOUTH ANNA RIVER	Medium	High
F08	CONTRARY CREEK	Medium	Low
F11	LOWER LITTLE RIVER	Medium	Low
F12	UPPER PAMUNKY RIVER/MECHUMPS CREEK	Medium	Low
F13	MIDDLE PAMUNKY RIVER/BLACK CREEK/TOTOPOTOMOY CREEK	Medium	Low
F15	NI RIVER	Medium	Low
F19	SOUTH RIVER	Medium	Medium
F26	UPPER YORK RIVER/POROPOTANK RIVER/QUEEN CREEK/WARF	Medium	High

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
G02	JAMES RIVER/TURKEY ISLAND CREEK/FOURMILE CREEK	Medium	Low
G03	JAMES RIVER/POWELL CREEK/WEST RUN/BAILEY CREEK	Medium	High
G06	CHICKAHOMINY RIVER/WHITE OAK SWAMP/BEAVERDAM CREEK	Medium	High
G07	CHICKAHOMINY RIVER/RUMLEY MARSH	Medium	Medium
G08	LOWER CHICKAHOMINY RIVER/MORRIS CREEK/LOWER	Medium	High
G12	SPEIGHTS RUN/LAKE COHOON/LAKE MEADE/LAKE KILBY	Medium	Medium
G13	NANSEMOND RIVER/BENNETT CREEK	Medium	Medium
H04	HARRIS CREEK	Medium	Low
H05	JAMES RIVER/BEAVER CREEK/BECK CREEK	Medium	Low
H09	UPPER TYE RIVER	Medium	Medium
H18	NORTH FORK HARDWARE RIVER/SOUTH FORK HARDWARE RIVER	Medium	Low
H23	MECHUMS RIVER	Medium	High
H26	SOUTH FORK RIVANNA RIVER/IVY CREEK	Medium	Low
H31	LOWER RIVANNA RIVER/BALLINGER CREEK	Medium	Medium
H38	JAMES RIVER/BEAVERDAM CREEK/FINE CREEK	Medium	Medium
I01	UPPER JACKSON RIVER	Medium	Medium
I09	LOWER JACKSON RIVER/WILSON CREEK/KARNES CREEK	Medium	Medium
I15	STUART RUN	Medium	Low
I25	CATAWBA CREEK	Medium	Medium
I26	LOONEY CREEK/MILL CREEK	Medium	Low
I28	JAMES RIVER/ELK CREEK/CEDAR CREEK	Medium	Medium
I37	LOWER MAURY RIVER/POAGUE RUN	Medium	Medium
I38	BUFFALO CREEK	Medium	Low
J07	APPOMATTOX RIVER/SKINQUARTER CREEK/ROCKY FORD CREEK	Medium	Low
J16	UPPER SWIFT CREEK/SWIFT CREEK RESERVOIR	Medium	Low
J17	LOWER SWIFT CREEK	Medium	High
K05	MEHERRIN RIVER/GENITO CREEK/ALLEN CREEK	Medium	Low
K07	ROSES CREEK	Medium	Low
K09	MEHERRIN RIVER/FALLING RUN	Medium	High
K12	LOWER FONTAINE CREEK/MILL SWAMP	Medium	Medium
K13	LOWER MEHERRIN RIVER/TARRARA CREEK/FLAT SWAMP	Medium	Medium
K16	NOTTOWAY RIVER/TOMMIFHTON CREEK/CROOKED CREEK	Medium	High
K28	NOTTOWAY RIVER/MILL SWAMP/NOTTOWAY SWAMP	Medium	Medium
K31	BLACKWATER SWAMP/WARWICK SWAMP	Medium	Medium
K41	NORTH LANDING RIVER	Medium	High
K42	BACK BAY	Medium	High

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
I 03	UPPER ROANOKE RIVER	Medium	High
L06	BACK CREEK	Medium	
I 07	ROANOKE RIVER/SMITH MOUNTAIN LAKE/BEAVERDAM CREEK	Medium	
L25	BIG OTTER RIVER/ELK CREEK	Medium	Medium
L27	BIG OTTER RIVER/BUFFALO CREEK	Medium	Low
L29	FLAT CREEK	Medium	Low
I 56	FATHERWOOD CREEK	Medium	Low
I 57	DAN RIVER/CASCADE CREEK	Medium	Low
L59	SANDY CREEK (WEST)	Medium	Low
L64	DAN RIVER/LAWSON'S CREEK/MIRY CREEK	Medium	Low
I 69	STINKING RIVER	Medium	Low
I 71	LOWER BANISTER RIVER/POLECAT CREEK	Medium	Low
L75	JOHN KERR RESERVOIR/BUTCHER CREEK	Medium	Medium
L78	LAKE GASTON/ALLEN CREEK/COX CREEK	Medium	Low
L79	LAKE GASTON/MILES CREEK/FLAT CREEK/SMITH CREEK	Medium	Low
M03	UPPER ARARAT RIVER	Medium	Medium
N01	HELTON CREEK/BIG HORSE CREEK	Medium	Medium
N02	UPPER NEW RIVER/WILSON CREEK	Medium	High
N03	FOX CREEK	Medium	Medium
N04	NEW RIVER/PFACH BOTTOM CREEK/LITTLE RIVER	Medium	Medium
N07	CROOKED CREEK	Medium	High
N08	NEW RIVER/SHORTS CREEK/PINE RUN	Medium	Low
N11	LOWER REED CREEK	Medium	Medium
N12	COVE CREEK	Medium	Low
N14	LOWER BIG REED ISLAND CREEK/GREASY CREEK/BURKS FORK	Medium	High
N15	LITTLE REED ISLAND CREEK	Medium	Medium
N20	WEST FORK LITTLE RIVER	Medium	High
N23	NEW RIVER/SINKING CREEK	Medium	Medium
N24	NEW RIVER/LITTLE STONY CREEK	Medium	High
N25	WALKER CREEK	Medium	Medium
N30	UPPER WOLF CREEK	Medium	Low
O01	UPPER SOUTH FORK HOLSTON RIVER	Medium	Low
O02	SOUTH FORK HOLSTON RIVER/WHITETOP LAUREL CREEK	Medium	High
O04	MIDDLE FORK HOLSTON RIVER/HUNGRY MOTHER CREEK	Medium	High
O08	REEDY CREEK	Medium	Low
O09	UPPER NORTH FORK HOLSTON RIVER	Medium	Medium

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
O12	NORTH FORK HOUSTON RIVER/ABRAMS CREEK	Medium	High
P03	CLINCH RIVER/MIDDLE CREEK	Medium	High
P04	CLINCH RIVER/SWORDS CREEK/Lewis CREEK	Medium	High
P09	CLINCH RIVER/LITTLE STONY CREEK	Medium	High
P11	GUEST RIVER	Medium	Medium
P13	CLINCH RIVER/STOCK CREEK/COVE CREEK	Medium	High
P15	NORTH FORK CLINCH RIVER	Medium	Low
P17	UPPER POWELL RIVER/CAHILLAN CREEK/ROARING FORK	Medium	Low
A18	LOWER CEDAR RUN/TOWN RUN	Low	Low
A33	POTOMAC RIVER/YEOCOMICO RIVER	Low	Medium
B03	UPPER SOUTH FORK SOUTH BRANCH POTOMAC RIVER	Low	Low
B04	SIFFY CREEK	Low	Low
B05	UPPER BACK CREEK/ISAACS CREEK	Low	Low
B06	HOGUE CREEK	Low	Low
B07	LOWER BACK CREEK/BRUSH CREEK/BABBS RUN	Low	Medium
B16	UPPER NORTH RIVER	Low	Low
B20	UPPER DRY RIVER	Low	Medium
B31	MIDDLE SOUTH RIVER/BACK CREEK	Low	High
B33	UPPER SOUTH FORK SHENANDOAH RIVER	Low	High
B35	SOUTH FORK SHENANDOAH RIVER/FICK RUN/BOONE RUN	Low	Low
B36	NAKED CREEK	Low	Medium
B37	SOUTH FORK SHENANDOAH RIVER/CUB RUN	Low	Low
B38	SOUTH FORK SHENANDOAH RIVER/MILL CREEK	Low	Low
B39	HAWKSRIE CREEK	Low	Medium
B42	UPPER NORTH FORK SHENANDOAH RIVER/GERMAN RIVER	Low	Low
B43	NORTH FORK SHENANDOAH RIVER/LITTLE DRY RIVER	Low	Low
B44	NORTH FORK SHENANDOAH RIVER/SHOEMAKER RIVER	Low	Medium
B51	LOWER NORTH FORK SHENANDOAH RIVER/TUMBLING RUN	Low	Medium
B52	UPPER CEDAR CREEK	Low	Medium
B54	PASSAGE CREEK	Low	Medium
B58	LOWER SHENANDOAH RIVER	Low	High
C02	DRAGON SWAMP	Low	High
C10	CHESAPEAKE BAY/HOUDENS CREEK	Low	High
E03	HUGHES RIVER	Low	Low
E04	UPPER HAZEL RIVER	Low	Low
F05	UPPER THORNTON RIVER	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
F10	RAPPAHANNOCK RIVER/DFFP RUN/ROCK RUN	Low	Low
E11	UPPER RAPIDAN RIVER/CONWAY RIVER	Low	Medium
F12	RAPIDAN RIVER/SOUTH RIVER	Low	Medium
E18	LOWER RAPIDAN RIVER	Low	Medium
E21	RAPPAHANNOCK RIVER/MILL CREEK/GOLDENVALE CREEK	Low	High
E25	RAPPAHANNOCK RIVER/LAGRANGE CREEK/LANCASTER CREEK	Low	Medium
F02	SOUTH ANNA RIVER/ROUNDAABOUT CREEK	Low	Low
F03	SOUTH ANNA RIVER/TAYLORS CREEK	Low	Low
F05	NEWFOUND RIVER	Low	Low
F06	UPPER NORTH ANNA RIVER	Low	Low
F07	LAKE ANNA/PAMUNKY CREEK	Low	Low
F09	LOWER NORTH ANNA RIVER/NORTHEAST CREEK	Low	Low
F10	UPPER LITTLE RIVER	Low	Low
F14	LOWER PAMUNKY RIVER	Low	High
F16	PO RIVER	Low	Medium
F17	UPPER MATTAPONI RIVER/PONI RIVER	Low	High
F18	MATTA RIVER	Low	Low
F21	MATTAPONI RIVER/HERRING CREEK/CHAPEL CREEK	Low	Medium
F22	MARACOSSIC CREEK/BEVERLY RUN	Low	High
F23	MATTAPONI RIVER/GARNETT'S CREEK	Low	High
F24	MATTAPONI RIVER/COURTHOUSE CREEK	Low	High
F25	LOWER MATTAPONI RIVER	Low	Low
G04	JAMES RIVER/WARDS CREEK/UPPER CHIPPOKES CREEK	Low	High
G09	UPPER DIASCLUND CREEK/DIASCLUND CREEK RESERVOIR	Low	Low
G14	WESTERN BRANCH RESERVOIR	Low	Medium
H01	JAMES RIVER/REED CREEK	Low	Low
H02	PEDLAR RIVER	Low	High
H06	WOLF CREEK AND CREEK	Low	Low
H07	BENT CREEK	Low	Low
H08	JAMES RIVER/DAVID CREEK	Low	Low
H10	PINEY RIVER	Low	Low
H11	UPPER BUFFALO RIVER	Low	Low
H12	LOWER BUFFALO RIVER	Low	Low
H13	LOWER TYE RIVER/RUCKER RUN	Low	Low
H14	JAMES RIVER/SYCAMORE CREEK	Low	Low
H15	NORTH FORK ROCKFISH RIVER/SOUTH FORK ROCKFISH RIVER	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
H16	LOWER ROCKFISH RIVER	Low	Low
H17	JAMES RIVER/TOTIER CREEK/ROCK ISLAND CREEK	Low	Low
H19	HARDWARF RIVER	Low	Low
H20	JAMES RIVER/BEAR GARDEN CREEK/SOUTH CREEK	Low	Low
H21	UPPER SLATE RIVER	Low	Low
H22	LOWER SLATE RIVER	Low	Low
H24	MOORMANS RIVER	Low	Medium
H25	BLACK MOUNTAIN CREEK	Low	Low
H27	NORTH FORK RIVANNA RIVER/SWIFT RUN/PREDDY CREEK	Low	Low
H30	MECHUNK CREEK	Low	Low
H32	CUNNINGHAM CREEK	Low	Low
H33	JAMES RIVER/DEEP CREEK/MUDDY CREEK	Low	Medium
H34	BYRD CREEK	Low	Low
H35	UPPER WILLIS RIVER	Low	Low
H36	LOWER WILLIS RIVER	Low	Low
H37	BIG LICKINGHOLE CREEK	Low	Low
I02	BACK CREEK	Low	Medium
I03	LAKE MOOMAW/HUGHES DRAFT	Low	Medium
I05	CEDAR CREEK	Low	Low
I06	COVE CREEK/SWIFT SPRINGS CREEK	Low	Low
I07	DUNLAP CREEK	Low	Low
I08	OGLE CREEK	Low	Low
I10	UPPER POTTS CREEK	Low	High
I11	LOWER POTTS CREEK	Low	Medium
I12	UPPER COWPASTURE RIVER	Low	Medium
I13	BULLPASTURE RIVER	Low	Medium
I14	COWPASTURE RIVER/THOMPSON CREEK/DRY RUN	Low	Medium
I16	COWPASTURE RIVER/MILL CREEK	Low	Medium
I17	LOWER COWPASTURE RIVER/SIMPSON CREEK/PADS CREEK	Low	Medium
I19	UPPER CRAIG CREEK	Low	Medium
I21	JOHNS CREEK	Low	High
I22	LOWER CRAIG CREEK/PATTERSON CREEK/LOWER BARBOURS	Low	High
I23	UPPER BARBOURS CREEK	Low	Low
I24	JAMES RIVER/LAPSLEY RUN	Low	Low
I27	JAMES RIVER/JENNINGS CREEK	Low	Low
I29	UPPER CAIPASTURE RIVER	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
I30	LOWER CAIPASTURE RIVER/MILL CREEK	Low	Medium
I31	BRATTONS RUN	Low	Low
I32	LITTLE CAIPASTURE RIVER	Low	Medium
I36	SOUTH RIVER	Low	Medium
J01	UPPER APPOMATTOX RIVER	Low	Medium
J02	BUFFALO CREEK/SPRING CREEK	Low	Low
J03	SANDY RIVER	Low	Low
J04	BLUSH RIVER	Low	Low
J05	BRIERY CREEK	Low	Low
J06	APPOMATTOX RIVER/BIG GUINEA CREEK/SAYLERS CREEK	Low	Low
J08	FLAT CREEK	Low	Low
J09	NIBBS CREEK	Low	Low
J10	APPOMATTOX RIVER/SMACKS CREEK/SAPPONY CREEK	Low	Low
J11	DEEP CREEK	Low	Low
J12	LAKE CHESDIN/WINTERPOCK CREEK/WINTICOMACK CREEK	Low	Low
J13	NAMOWINE CREEK	Low	Low
J14	LAKE CHESDIN/WHIPPONOCK CREEK	Low	Low
K01	SOUTH MEHERRIN RIVER/MIDDLE MEHERRIN RIVER	Low	Medium
K02	NORTH MEHERRIN RIVER	Low	Medium
K03	UPPER MEHERRIN RIVER/FLAT ROCK CREEK/MASON CREEK	Low	Low
K04	MEHERRIN RIVER/STONY CREEK/TAYLORS CREEK	Low	Low
K06	GREAT CREEK	Low	Low
K08	MEHERRIN RIVER/REEDY CREEK	Low	Low
K10	UPPER FONTAINE CREEK/RATTLESNAKE CREEK	Low	Low
K11	MIDDLE FONTAINE CREEK/CATTAIL CREEK/BEAVERPOND CREEK	Low	High
K14	UPPER NOTTOWAY RIVER/BIG HOUNDS CREEK	Low	High
K15	LITTLE NOTTOWAY RIVER	Low	Low
K17	NOTTOWAY RIVER/WAQUA CREEK	Low	Low
K18	STURGEON CREEK	Low	Low
K19	NOTTOWAY RIVER/BUCKSKIN CREEK/HARRIS SWAMP	Low	High
K20	BUTTERWOOD CREEK/WHITE OAK CREEK	Low	Medium
K21	STONY CREEK/SOUTHWEST SWAMP	Low	Medium
K22	SAPPONY CREEK	Low	Medium
K23	NOTTOWAY RIVER/ROWANTY CREEK/JONES HOLE SWAMP	Low	High
K24	NOTTOWAY RIVER/HUNTING QUARTER SWAMP	Low	High
K25	RACCOON CREEK/SPRING CREEK	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
K26	UPPER THREE CREEK/OTTERDAM SWAMP	Low	Medium
K27	LOWER THREE CREEK/ANGELICO CREEK/POPLAR SWAMP	Low	Low
K29	ASSAMOUSICK SWAMP	Low	Low
K32	UPPER BLACKWATER RIVER/CYPRESS SWAMP	Low	High
K33	MIDDLE BLACKWATER RIVER	Low	High
K34	RATTLESNAKE SWAMP/MILL SWAMP	Low	High
K35	SEACOCK SWAMP	Low	High
K36	LOWER BLACKWATER RIVER/KINGSAIL SWAMP/CORROWAUGH	Low	High
K37	UPPER CHOWAN RIVER/BUCKHORN CREEK	Low	Low
K38	SOMERTON CREEK	Low	High
K39	DISMAIS SWAMP/CYPRESS SWAMP	Low	High
L01	SOUTH FORK ROANOKE RIVER/BOTTOM CREEK/ELLIOTT CREEK	Low	High
L02	NORTH FORK ROANOKE RIVER/BRADSHAW CREEK	Low	High
L08	UPPER BLACKWATER RIVER	Low	Medium
L10	LOWER BLACKWATER RIVER/SMITH MOUNTAIN LAKE	Low	Low
L11	GILLS CREEK	Low	Low
L13	LEESVILLE LAKE/OLD WOMANS CREEK	Low	Low
L14	UPPER PIGG RIVER	Low	High
L15	BIG CHESTNUT CREEK/LITTLE CHESTNUT CREEK	Low	Medium
L16	MIDDLE PIGG RIVER	Low	Medium
L17	SNOW CREEK/TURKEYCOCK CREEK	Low	Low
L18	LOWER PIGG RIVER	Low	Medium
L19	ROANOKE RIVER/SYCAMORE CREEK	Low	Low
L20	UPPER GOOSE CREEK	Low	Low
L21	MIDDLE GOOSE CREEK/BORE AUGER CREEK/WOLF CREEK	Low	Medium
L22	LOWER GOOSE CREEK	Low	Low
L23	UPPER BIG OTTER RIVER	Low	Low
L24	NORTH OTTER CREEK	Low	Medium
L28	LOWER BIG OTTER RIVER	Low	Low
L30	ROANOKE RIVER/STRAIGHTSTONE CREEK/CHILDREY CREEK	Low	Medium
L31	SENECA RIVER	Low	Low
L32	UPPER FALLING RIVER	Low	Medium
L33	SOUTH FORK FALLING RIVER	Low	Low
L34	LOWER FALLING RIVER/LITTLE FALLING RIVER	Low	Low
L35	MOLLEYS CREEK	Low	Low
L36	ROANOKE RIVER/TURNIP CREEK/CATAWBA CREEK	Low	Low

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
I 37	CLUB CREEK	Low	Medium
L38	ROANOKE RIVER/HUNTING CREEK/WALLACE BRANCH	Low	Low
I 39	ROANOKE CREEK/HORSEFEEN CREEK/WARDS FORK CREEK	Low	Medium
L40	ROANOKE RIVER/SANDY CREEK	Low	Low
L41	DIFFICULT CREEK	Low	Low
L42	UPPER DAN RIVER/LITTLE DAN RIVER	Low	High
I 43	UPPER SOUTH MAYO RIVER/RUSSELL CREEK	Low	High
I 44	SPOON CREEK	Low	Low
L45	LOWER SOUTH MAYO RIVER	Low	Medium
L46	NORTH MAYO RIVER	Low	Medium
I 47	HORSE PASTURE CREEK	Low	Low
I 48	MAYO RIVER	Low	Low
L50	UPPER SMITH RIVER	Low	High
L51	SMITH RIVER/PHILPOTT RESERVOIR/RENNET BAG CREEK	Low	Medium
L52	SMITH RIVER/TOWN CREEK/BLACKBERRY CREEK	Low	Low
I 55	MARROWBONE CREEK	Low	Low
L62	DAN RIVER/SANDY CREEK (EAST)/WINNS CREEK	Low	Low
L63	BIRCH CREEK	Low	Low
L65	UPPER BANISTER RIVER	Low	Low
I 66	CHERRYSTONE CREEK	Low	Low
L67	MIDDLE BANISTER RIVER/ELKHORN CREEK	Low	Medium
L68	WHITEHORN CREEK	Low	Low
L70	SANDY CREEK	Low	Low
I 72	TERRIBLE CREEK	Low	Low
L73	DAN RIVER/AARONS CREEK	Low	Medium
L74	HYCO RIVER/BIG BLUEWING CREEK/MAYO CREEK	Low	Low
L76	BUFFALO CREEK	Low	Low
I 77	BLUESTONE CREEK/LITTLE BLUESTONE CREEK	Low	Medium
L80	LAKE GASTON/GREAT CREEK	Low	Low
L81	LAKE GASTON/POPLAR CREEK	Low	Low
L82	LAKE GASTON/PEA HILL CREEK	Low	Low
M01	FISHRIVER/LITTLE FISHRIVER	Low	Low
M02	STEWARTS CREEK/PALMS CREEK/OVILIS CREEK	Low	Medium
N16	NEW RIVER/CLAYTOR LAKE/MACKS CREEK	Low	Low
N17	PEAK CREEK	Low	Low
N22	NEW RIVER/TOMS CREEK/BACK CREEK/STROUBERS CREEK	Low	High

Watershed ID	Watershed Name	NPS Ranking	Natural Heritage Ranking
N26	KIMBERLING CREEK	Low	Medium
N27	LITTLE WALKER CREEK	Low	Low
N28	STONY CREEK	Low	Medium
N29	NEW RIVER/EAST RIVER	Low	Low
N31	HUNTING CAMP CREEK	Low	Low
N32	LOWER WOLF CREEK/CLEAR FORK	Low	Low
N33	LAUREL CREEK	Low	Low
N34	RICH CREEK	Low	Low
N35	NEW RIVER/ADAIR RUN	Low	Low
N36	UPPER BLUESTONE RIVER	Low	Low
N37	BLUESTONE RIVER/LAUREL FORK	Low	Low
O03	UPPER MIDDLE FORK HOLSTON RIVER	Low	Low
P02	CLINCH RIVER/INDIAN CREEK	Low	High
P08	DUMPS CREEK	Low	Low
P10	LICK CREEK	Low	Low
P12	STONY CREEK	Low	Medium
P16	CLINCH RIVER/BLACKWATER CREEK	Low	Low
P18	SOUTH FORK POWELL RIVER	Low	Medium
P19	POWELL RIVER/CAMP CREEK	Low	Medium
P21	POWELL RIVER/HARDY CREEK	Low	High
P22	WALLEN CREEK	Low	High
P23	POWELL RIVER/MARTIN CREEK	Low	High
P24	POWELL RIVER/INDIAN CREEK	Low	Medium
O01	DRY FORK/JACOBS FORK/HORSEFEEN CREEK	Low	Low
O02	TUG FORK	Low	Low
O03	KNOX CREEK	Low	Low
O04	UPPER LEVISA FORK/GARDEN CREEK	Low	Low
O05	DISMALE CREEK	Low	Low
O06	LEVISA FORK/PRATER CREEK	Low	Low
O07	SLATE CREEK	Low	Low
O08	LEVISA FORK/HOME CREEK/BULL CREEK	Low	Low
O09	UPPER RUSSSELL FORK	Low	Low
O10	RUSSSELL FORK/LICK CREEK/FRYINGPAN CREEK	Low	Low
O11	MCCLURE RIVER/CANEY CREEK	Low	Low
O12	RUSSELL FORK/RUSSELL PRATER CREEK	Low	Medium
O14	CRANESNEST RIVER	Low	Low

Chapter 3.5 ESTUARY AND COASTAL ASSESSMENT AND PROGRAM INITIATIVES

The Commonwealth of Virginia has 120 miles of Atlantic Ocean coastline and almost 2,500 square miles of estuary. This resource has a prominent place in both Virginia's history and culture. It is valued for its commercial fishing, wildlife, sporting, and recreational opportunities, as well as its commercial values in shipping and industry. In the late 1970's, adverse trends in water quality and living resources were noted and prompted creation of the Federal-Interstate Chesapeake Bay Program (CBP).

Through participation in the CBP and implementation of special state initiatives, Virginia maintains a firm commitment to rehabilitate and wisely manage its estuarine resources. Because nearly all of Virginia's estuarine waters flow into the Chesapeake Bay, the activities of the CBP apply to Virginia's estuaries in general. This chapter provides an overview of the state's strategies and activities intended to cleanse and preserve the Chesapeake Bay and its tidal tributaries.

Chesapeake Bay Program

In 1983, Virginia, Maryland, Pennsylvania, the District of Columbia, the Environmental Protection Agency, and the Chesapeake Bay Commission formally agreed, by signing the Chesapeake Bay Agreement, to undertake the restoration and protection of the Bay using a cooperative Chesapeake Bay Program approach. This approach established specific mechanisms for its coordination among the Program participants. Recognizing the need for an expanded and refined commitment to the Bay's restoration, a new Bay Agreement was signed in 1987. The new agreement contained goals and priority commitments in six areas: **Living Resources; Water Quality; Population Growth and Development; Public Information, Education, and Participation; Public Access; and Governance.**

A key Water Quality goal established by the 1987 Agreement was to reduce, by the year 2000, the annual nutrient load of nitrogen and phosphorus entering the Bay from controllable sources by 40%. The starting point, or "baseline", for this reduction effort is the sum total of 1985 point source loads (discharges from municipal and industrial treatment plants) and non-point source loads (runoff from agricultural, forested and urban areas) in an average rainfall year. Achieving this 40% reduction is expected to improve dissolved oxygen levels and water clarity conditions in the Bay which in turn will help improve the habitats and health of living resources.

In 1992, the nutrient reduction goal was reevaluated using information from a variety of sources, most notably water quality monitoring and modeling programs. As a result, the Bay Program's Executive Council, comprised of the governors of Maryland, Pennsylvania, and Virginia; the mayor of the District of Columbia; the administrator of the EPA, representing the federal government; and the chairman of the Chesapeake Bay Commission, reaffirmed its commitment to the 40% goal in a set of 1992 Amendments to the Bay Agreement. The Amendments also directed that tributary-specific nutrient reduction strategies be developed to achieve and maintain the goal, as well as to protect and improve aquatic habitats within those rivers.

In Virginia, the Department of Environmental Quality (DEQ) has primary responsibility for point source discharge issues, bringing together programs in the areas of surface and groundwater protection, waste management, and air pollution control. The Department of Conservation and Recreation (DCR) has the lead for nonpoint source control programs. Other state agencies that provide vital support include: Game and Inland Fisheries, Forestry, Health, Chesapeake Bay Local Assistance, Marine Resources Commission, Agriculture and Consumer Services, along with higher education units Virginia Institute of Marine Science and Old Dominion University. Staff from these state agencies represent Virginia on a variety of subcommittees and technical workgroups of the interstate CBP.

Virginia's Tributary Strategy Process

Virginia regards the reduction of nutrients through the tributary strategy program as a high priority. The Commonwealth is committed to achieving substantial nutrient reductions in the drainage basins of the Shenandoah and Potomac Rivers as well as the lower tributaries and smaller coastal basins of the Bay. While the strategy for each basin will differ, the development process and the principles behind that process will remain uniform. Agencies under the Secretary of Natural Resources continue to work closely with local governments, Planning District Commissions, Soil and Water Conservation Districts, sanitation and wastewater authorities, conservation and river-user groups, and other stakeholders to develop strategies that are practical, equitable, and cost-effective. Virginia continues to emphasize a cooperative approach and thus, participation in the development and implementation of tributary strategies remains strictly voluntary.

The reevaluation of the Bay wide nutrient reduction goal, conducted in 1991-92, which led to the adoption of the 1992 Amendments, yielded an important finding about Virginia's tributaries and their impact on the Bay's water quality. It was determined that the nutrient loads from the Potomac River basin and basins to the north have the greatest influence on dissolved oxygen conditions in the Bay, whereas the southerly tributaries -- the Rappahannock, York, James and small coastal basins -- contribute little, if any, to the Bay's water quality problems in terms of excess nutrient impacts.

For this reason, Virginia has taken a two-pronged approach towards its tributary strategies. These include a concentrated effort in the Shenandoah-Potomac basin to meet the 40% goal and, at the same time, expanding the monitoring and modeling efforts in the lower tributaries to help determine appropriate nutrient reduction goals, as needed, to enhance water quality within these rivers themselves.

The expanded monitoring was completed in 1994 and the watershed model is currently in the final stage of refinement. The latest estimate for tributary specific water quality information for Virginia's lower tributaries will be available by mid -1998 for the purpose of lower tributary nutrient reduction goal setting. The goal setting process, and the final nutrient reduction goal for each of the lower tributaries, will reflect both the unique water quality and habitat conditions of each tributary, and its present and probable future patterns of land and water uses. Until the final modeling data is available, the lower tributary strategies will proceed using 40% as an interim reduction goal.

Shenandoah-Potomac Tributary Nutrient Reduction Strategy

In December of 1996, Virginia completed and submitted the first of its tributary strategies. The Shenandoah and Potomac River Basin Tributary Nutrient Reduction Strategy (Strategy) was the culmination of three years of cooperative work among several of the Commonwealth's Natural Resources agencies, local government officials and other interested citizens and stakeholders. The Strategy outlines a series of management actions, for both point and nonpoint sources of nutrients, that are needed to achieve the 40% nutrient reduction goal established by the Chesapeake Bay Program for this river basin. Currently, efforts are being focussed on assisting localities and others in developing grant applications for funding to implement their recommended nutrient reduction strategies.

Virginia's strategy process is an ongoing effort, with the objective being to address the need for nutrient reduction, as well as maintain the load "cap" once achieved, through development and expansion of management programs that are feasible, equitable, and cost-effective.

Virginia Legislative Actions Supporting the Tributary Strategy Program

➤ Virginia Tributary Strategies Legislation

The 1996 Virginia General Assembly amended the Code of Virginia (§2.1-51.12:1-3) to provide specific direction to the development of Tributary Plans. This Article outlined the required

contents for tributary plans, provided developmental deadlines for Virginia's lower tributary plans, and set a January 1, 1997 deadline for the Potomac River Basin. In February 1997, the Article itself was amended to extend the deadlines for completion of the lower tributary and coastal basin strategies. The amended deadlines are: Rappahannock River Basin, January 1, 1999; York River Basin, July 1, 1998; James River Basin, July 1, 1998; and the Eastern and Western Coastal Basins, January 1, 1999.

➤ Virginia Water Quality Improvement Act of 1997

Motivated by the need to finance the completed Shenandoah-Potomac River Nutrient Reduction Strategy and the lower basin strategies still being developed, the Governor introduced a bill during the 1997 VA General Assembly, to aid the financing of Virginia's tributary strategy program. The resulting legislation was the Virginia Water Quality Improvement Act of 1997 which the Governor signed into law on March 20, 1997.

The Act recognizes that the protection of the quality of state waters is a responsibility shared among state and local governments, as well as individuals. In order to enhance the purposes of the State Water Control Board and the other state laws related to the restoration, protection and improvement of the quality of state waters, the Act established cooperative programs to reduce nutrients and other point and nonpoint sources of pollution.

Under the cooperative point source program, DEQ is directed to assist local governments and individuals in the control of point source pollution, including nutrient reductions, through technical and financial assistance.

➤ Water Quality Improvement Fund

The Virginia Water Quality Improvement Act of 1997 also established the Virginia Water Quality Improvement Fund (WQIF). The purpose of the fund is to provide grants to local governments, soil and water conservation districts and individuals for point and nonpoint source pollution prevention and reduction programs. Under the Act, the Director of DEQ is responsible for point source grants and the Director of DCR is responsible for nonpoint source grants.

In accordance with the Act, until tributary strategies are developed and implemented, the DEQ Director is only authorized to distribute point source grants from the WQIF that provide at least 50% of the cost of design and installation of biological nutrient removal (BNR) facilities or other nutrient removal technology at publicly owned treatment works (POTWs). During Fiscal Year 1998 the only POTWs eligible for funding are those located in the Shenandoah and Potomac basins. The reasoning behind this decision stems from the fact that reduction strategies for these basins are the only ones which have been completed at this time. The Act does, however, allow the Director to authorize point source grants at anytime and in any basin for technical assistance relating to nutrient reduction.

Twenty applications, requesting a total of \$59.63 million in grant funds, were received by the August 1997 submission deadline. Of the applications received, sixteen were for installation of nutrient removal facilities at POTWs; three were jointly submitted for a new public-private land application process that would serve two localities and two industries; and one application was received for a technical assistance grant. As a result of preliminary review of the applications, seventeen (17) were selected for funding consideration. All approved WQIF Grant agreements will be made available for public review and comment for at least 30 days prior their execution, and will be governed by a legally binding, enforceable agreement as required by the Water Quality Improvement Act.

Nutrient Loadings

Since Virginia began working toward reducing nutrient loadings to the Chesapeake Bay and its

tributaries, significant nutrient reductions have been achieved. Much of these nutrient reductions can be attributed to greater use of best management practices (BMPs) by farmers and foresters, enhanced nutrient removal, including biological nutrient removal (BNR), at wastewater treatment plants, the 1988 phosphate detergent ban, Virginia's adoption of water quality standards for ammonia, improved erosion and sediment control programs, and other initiatives.

Table 3.5-1 presents the 1985 vs 1996 nitrogen and phosphorus loads discharged from point sources within each of Virginia's tributary basins to the Chesapeake Bay. The table also shows the percent change in loads from the 1985 baseline.

Table 3.5 - 1 1985/1996 Virginia Point Source Nutrient Loads, with percent changes from 1985 baseline.

RIVER BASIN	# OF SOURCES	PHOSPHORUS (LBS / YR)		PHOSPHORUS % CHANGE FROM 1985	NITROGEN (LBS / YR)		NITROGEN % CHANGE FROM 1985
		1985	1996		1985	1996	
Potomac	32	690,000	453,000	-34%	10,702,000	11,617,000	+ 9%
Rappahanock	11	181,000	81,000	-55%	477,000	597,000	+ 25%
York	8	421,000	204,000	-52%	1,309,000	1,765,000	+ 35%
James	32	3,590,000	1,557,000	-57%	23,534,000	19,596,000	-17%
Coastal	8	297,000	167,000	-44%	1,303,000	1,945,000	+ 49%
TOTAL	91	5,179,000	2,462,000	-52%	37,325,000	35,519,000	-5%

The overall percent reduction for point source phosphorus loads between 1985 and 1996 is 52%, and for nitrogen it is 5%. These loading reductions have been achieved even with an increase of more than 20% in wastewater flows during those eleven years. This demonstrates that nutrient reductions have proceeded over the past decade even without the benefit of completed tributary strategies. With the completion of the Shenandoah-Potomac Strategy at the end of 1996, the rate of nutrient reduction in that basin is expected to accelerate significantly. Once strategies are completed for the other river basins, the pace of nutrient reduction in those basins should also accelerate.

Water Quality and Habitat Monitoring Program

The Chesapeake Bay Program (CBP) provides information to guide the implementation of nutrient and toxics reduction strategies. The purpose of the Water Quality and Habitat Monitoring Program is to assess trends in water quality and organism abundance throughout the Virginia portion of the Bay. The productivity, diversity, and abundance of living resources are the ultimate measures of the Chesapeake Bay's condition. Monitoring these organisms along with standard chemical and physical indicators of water quality can help determine the conditions that must be established and maintained to ensure the well-being of the Bay's resources. As a part of this program, 40 tributary stations were sampled in 1993, 59 tributary stations were sampled in 1994 and 38 tributary stations were sampled in 1995. Virginia began fall line monitoring for nutrients in July 1988 on the James and Rappahannock Rivers under contract with the U.S. Geological Survey (USGS). Fall line monitoring for nutrients began in July 1989 in the Appomattox, Mattaponi, and Pamunkey Rivers. The frequency of sampling is increased during storm events, when large amounts of sediments and nutrients may be transported into the tidal portion of the watershed. USGS is utilizing the sampling data to develop accurate estimates of nutrient loads entering the Bay from above the fall line.

All mainstem Bay stations are sampled under contract by two universities. The Applied

Marine Research Laboratory at Old Dominion University sample 8 stations within the Bay and the Virginia Institute of Marine Science sample 19 stations. Water quality measurements include Secchi depth, temperature, salinity, chlorophyll, dissolved oxygen, nitrogen, phosphorus, carbon, and silica.

In order to develop better and more creditable tributary models, additional data needs were identified and the 1994 Virginia Enhanced Tributary Monitoring Program (VETMP) was designed.

The VETMP was a component of the ongoing water quality monitoring programs conducted by the Commonwealth of Virginia and its contractors. It consists of several important enhancements. First, since the existing tributary monitoring data are collected along the axis of the tributary channels, transects were added to enhance spatial coverage to include the shallow flanks and embayments where the majority of critical habitat and living resources are found. Secondly, the detection levels used in the 1993 tributary monitoring program restricted the amount of nutrient data available for modeling purposes because detection limits for ammonia, nitrate-nitrite, and dissolved inorganic phosphorus are above the water quality model calibration values. Third, the parameter list "was expanded" to include field measurements of particulate inorganic phosphorus (PIP), biogenic silica (BioSi) and direct measurements of carbon (POC and DOC) for the fall line and tributary stations. And fourth, a light attenuation meter was used and the initiation of field filtration of water samples which allow direct analysis of dissolved and particulate nitrogen and phosphorous in Virginia's tributaries. This enhanced data will be used to improve the 3D Model's capability to simulate water quality conditions in the tidal portions of the James, York, and Rappahannock Rivers.

VETMP began January 1, 1994 and ended December 31, 1994. The 1993 Virginia Tributary Monitoring Programs station list was augmented by including transects at eight existing tidal tributary stations, transects at the mouth of each tributary and adding four new main channel station locations. Monthly water quality sampling occurred at all of the stations and transects. All sampling was conducted by personnel from DEQ Regional Offices, ODU and VIMS. Routine water quality parameters were analyzed by DCLS, chlorophyll analysis was performed at VCU, and special parameter analysis performed by VIMS.

The only change within the main Bay stations, was the inclusion of PIP and BioSi during six sampling runs, with emphasis during the 1994 spring and summer months.

In 1995, all transect stations were discontinued along with three parameters (DOC, PIP and BioSi). Some of the new main channel stations remained active as CBM or AWQM stations due to the Department's further need for water quality information in these areas of the state. Sampling is conducted monthly with all filtration now being done on the boats. Light attenuation continues to be measured, and DCLS now does all analyses (except chlorophyll *a*) for the program.

A general description of the current monitoring regime is provided below:

- Water quality monitoring at 38 stations on the Rappahannock, York and James Rivers;
- Water quality monitoring at 27 stations in the Chesapeake Bay proper;
- Water quality monitoring and estimates of nutrient loading at the fall lines of the James, Appomattox, Mattaponi, Pamunkey, and Rappahannock Rivers;
- Monitoring of plankton communities in the mainstem of the Chesapeake Bay at 7 stations and in the tributaries at 6 stations;
- Monitoring of benthic communities in the Bay and its tributaries at 19 stations;
- Monitoring of chlorophyll *a* in the bay and its tributaries at all stations.

Toxics Reduction and Prevention Strategy

In 1989, the Executive Council adopted the Chesapeake Bay Basin wide Toxics Reduction Strategy called for in the 1987 Chesapeake Bay Agreement. The initial strategy focused on defining the nature, extent, and magnitude of chemical contaminant problems in the Chesapeake Bay and initiating specific chemical contaminant reduction and prevention actions. During the 1992 reevaluation, noted progress from toxics management activity included some chemical contaminant reductions in living resources and their habitats. In addition, there was little evidence of chemical contaminants causing severe, system wide impacts on the Bay. However, a few well-known areas were determined to have serious, localized chemical contaminant problems, and some areas that were previously thought to be uncontaminated showed some toxic effects.

Based on the reevaluation, the Executive Council adopted the Chesapeake Bay Basin wide Toxics Reduction and Prevention Strategy in October 1994. The goal was established to have the *"Bay free of toxics by reducing and eliminating the input of chemical contaminants from all controllable sources to levels that result in no toxic or bioaccumulative impact on living resources that inhabit the Bay or on human health."* The revised strategy includes the following actions: a Regional Focus- to address toxic problem areas; Directed Toxics Assessments- enhanced focus on biological and chemical contaminant assessments in direct support of management actions; Regulatory Program Implementation- complementary activity with existing toxics regulations; and, Pollution Prevention- increasing emphasis as a means of preventing the introduction of toxics into the Bay.

Regional Focus - The Elizabeth River Regional Action Plan for Toxics Reduction

The Elizabeth River, a sub-estuary of the James River, is the major deep water port of the Hampton Roads Harbor. The river system drains over 300 square miles in southeastern Virginia within the cities of Chesapeake, Norfolk, Portsmouth, and Virginia Beach. The Elizabeth River serves as the focal point for military activities, industry, and commerce in the Hampton Roads area. The watershed is among the most heavily urbanized and industrialized areas in the state.

In 1993, the Chesapeake Bay Program identified the Elizabeth River system as one of the most highly polluted bodies of water in the entire Bay watershed. In March 1995, the Commonwealth of Virginia entered into an agreement with the Elizabeth River Project (ERP), a private nonprofit organization, to recommend actions toward an Elizabeth River Regional Action Plan for Toxics Reduction. ERP, a Norfolk-based partnership of citizens, industry, governments, military, and recreational interests, had independently formed to develop an integrated watershed action plan for management of ecological and human health risk.

As a result of the agreement between the Commonwealth and ERP, an 18-item Watershed Action Plan was developed and presented in 1996. The eighteen individual actions are listed in Table 3.5-2. The Plan was the culmination of a year long effort by an ERP volunteer Watershed Action Team working in four task forces: a Habitat & Living Resources Task Force; a Sediment Quality Task Force; a Water Quality Task Force; and a Toxics Reduction Task Force. Actions presented by the team were chosen on the basis of three main criteria: effectiveness, afford ability and acceptability to the community.

Of the eighteen actions, Actions 1, 2, 5, 6, and 14 were identified by the Action Team as "critical areas" deserving the most initial resources. Some progress highlights include the following:

Actions 1 & 2 -An Elizabeth River initiative to remediate the river's toxic sediments and restore wetlands. These actions are to be conducted by the US Army Corps of Engineers and sponsored through a federal, state and local partnership. In 1997, a federally funded assessment by the Corps., identified (5) toxic "hot spots" for sediment cleanup and (14) sites for wetlands restoration.

Action 5 - In 1997 ERP began Businesses for a Cleaner River, a resource and referral service to assist government and business facilities with pollution prevention and wildlife habitat enhancement. Thirty such facilities have committed to developing these types of programs.

Action 6 - Recognizing that stormwater runoff is the leading source of toxics presently entering the Elizabeth River, the ERP has responded by providing educational programs designed to increase awareness in the public and business communities. Funds from the National Environmental Education and Training Foundation, as well as local cities, will pay for an interactive stormwater exhibit at the National Maritime Center in Norfolk, a traveling exhibit and a teacher training program.

Action 13 - \$200,000 was allocated by the VA General Assembly in its 1996-1998 budget for the removal of abandoned vessels in the Elizabeth River. The Virginia Marine Resource Commission began the initiative by conducting an extensive inventory which identified 145 abandoned vessels and more than 6,000 abandoned pilings. To date about 8 vessels have been removed, with an additional 8 slated for removal in early 1998.

Action 14 - In its 1996-1998 budget, the VA General Assembly provided \$250,000 to enhance toxics monitoring in the Elizabeth River by the Department of Environmental Quality. In response to this initiative, the DEQ developed the first comprehensive monitoring plan for the river. This plan calls for monitoring 38 stations to track trends in water quality, sediment quality, habitat and living resources. Initial monitoring under this plan, slated for 1998, will include about 12 of these stations. In addition to the efforts of DEQ, both Old Dominion University and the Virginia Institute of Marine Science have been awarded grants by NOAA to conduct investigations relating to toxics in sediments.

Table 3.5 - 2 The Eighteen Recommended Actions of the Elizabeth River Watershed Action Plan

Action 1 - <i>Reduce sediment contamination in the Elizabeth River to levels non-toxic to humans and aquatic life, remediating the highest priority contaminated sites by 2010.</i>	Action 10 - <i>Enhance compliance with existing regulations.</i>
Action 2 - <i>Increase vegetated buffers, wetlands acreage and forested areas.</i>	Action 11 - <i>Enhance marketability of Hampton Roads through achieving a cleaner environment, working with localities and the Chamber of Commerce's Plan 2007.</i>
Action 3 - <i>Implement habitat enhancement programs at 25% of business and government facilities in the watershed by the year 2005, and enhance backyard habitats.</i>	Action 12 - <i>Increase public access to the Elizabeth River for the purpose of increasing appreciation of the river and support for restoration.</i>
Action 4 - <i>Minimize erosion along rapidly eroding shorelines by 2010, also rehabilitating existing hardened shorelines to use naturalized erosion measures wherever possible.</i>	Action 13 - <i>Remove abandoned vessels and pilings, where possible also conserving or replacing habitat.</i>
Action 5 - <i>Establish pollution prevention and/or sustainable landscaping practices among 25% of residential, commercial and government land users in the watershed by the year 2005.</i>	Action 14 - <i>Establish and maintain an Elizabeth River monitoring program and data bank to provide the scientific foundation for protecting, restoring and sustaining living resources and human health in the Elizabeth River watershed.</i>
Action 6 - <i>Reduce pollution from stormwater runoff to the maximum practical extent.</i>	Action 15 - <i>Determine the ecological effects of Craney Island operations on the Elizabeth River, with the purpose of reaching consensus among interested parties about best management practices and remediation needs.</i>
Action 7 - <i>Identify and correct inadequate sanitary collection systems, for the purpose of reducing human health risks and ecological risks from bacterial contamination in the Elizabeth River.</i>	Action 16 - <i>Develop and implement a "load allocation approach" as a voluntary tool for making more informed, more cost-effective decisions on how to manage the Elizabeth River.</i>
Action 8 - <i>Reduce TBT to non-toxic levels in the Elizabeth River waters and sediment, while enhancing the opportunity for continued competitiveness of Virginia's shipping, shipbuilding and other related businesses.</i>	Action 17 - <i>Develop a nutrients task force to establish Elizabeth River nutrient goals and basis for goals, and to recommend control measures needed to achieve goals.</i>
Action 9 - <i>Promote mass transit and alternate transportation, based on a recognition of automotive usage as a major source of pollution in the Elizabeth River.</i>	Action 18 - <i>Build strong partnerships between the Elizabeth River Project and all public and private authorities relevant to this plan, for the purposes of promoting speedy, effective implementation and enhanced regional watershed planning.</i>

Additional on-going activity, under the Regional Focus section of the strategy, includes a toxics characterization of the entire tidal Bay watershed. The purpose of this characterization is to determine if additional chemical contaminant problem areas exist, similar to those areas identified as Regions of Concern (e.g., Elizabeth River) or Areas of Emphasis (areas with the potential for serious chemical contaminant-related impacts). Based on the results of the regional focus characterization, future toxics management actions will be considered within the impacted segments.

Directed Toxics Assessment

The CBP's second Toxics Loading and Release Inventory (TLRI) is scheduled to be released in July, 1998. Along with the SARA Title III data, this report will include loading estimates from all Virginia VPDES dischargers in the Bay watershed that have been regulated under the Commonwealth's Toxics Management Program. The effort will also include estimations of toxics loadings to the Bay watershed from non-point sources such as urban stormwater runoff, acid mine drainage, and atmospheric deposition.

This information will be compared with the 1994 report although the Virginia portion will be more comprehensive. The report shall provide insight on the effectiveness of Virginia's Programs for eliminating or reducing toxic chemicals in addition to helping managers establish goals toward further contaminant reduction.

The Chesapeake Bay Program annually supports ambient toxicity testing throughout the tidal Bay watershed as the toxic chemical loadings information does not yield information on biological effects. The standardized ambient toxicity program is used to quantify levels of toxicity in the targeted areas. Results for stations sampled during 1995 in Virginia are highlighted in Table 3.5-3 and have been considered in the overall 305(b) assessment. Priority areas for managing toxicity include high toxicity areas (such as the Elizabeth River) and low to moderate toxicity areas that are critical to the Bay's living resources (i.e., spawning areas). Areas showing lower levels of toxicity are not an immediate concern.

Table 3.5-3 1995 Ambient Toxicity Results

SAMPLE LOCATION	MEDIUM	DATE	RESULTS
<i>Elizabeth River*</i> Willoughby Bay Pamunkey River - (Below West Point)	Water Column	1990 1995 1995	High Degree of Toxicity High Degree of Toxicity High Degree of Toxicity
James River (Newport News) York River (Above Cheatham Annex)	Water Column	1995 1995	Low to Moderate Toxicity Low to Moderate Toxicity
Pamunkey River (Above West Point) York River (Below Cheatham Annex) Lynnhaven River	Water Column	1995 1995 1995	No Significant Toxicity No Significant Toxicity No Significant Toxicity
<i>Elizabeth River*</i> Willoughby Bay	Sediment	1990 1995	High Degree of Toxicity High Degree of Toxicity
James River (Below Newport News)	Sediment	1995	Low to Moderate Toxicity
Pamunkey River (2 sites) York River (2 sites) James River (Above Newport News) Lynnhaven River	Sediment	1995 1995 1995 1995	No Significant Toxicity No Significant Toxicity No Significant Toxicity No Significant Toxicity

* *Elizabeth River data included to provide a frame of reference.*

Source: USEPA CBP, Ambient Toxicity Testing in the Chesapeake Bay - Year 5 Report (EPA 903/R/98/008)

Regulatory Program Implementation

The toxics prevention and reduction commitments included in this section of the strategy build upon existing state and federal legislative and statutory mandates. This is applicable to eliminating toxic impacts from point sources and setting reduction targets for nonpoint sources which include atmospheric deposition, stormwater runoff and acid mine drainage. In addition, a list of key chemical contaminants (known as the Toxics of Concern) causing or having the potential to cause adverse problems in the Bay, has been identified. The strategy directs EPA to establish criteria for these contaminants.

Pollution Prevention - Businesses for the Bay

The Toxics Reduction and Prevention Strategy recognizes "pollution prevention" as the preferred approach for addressing the "Toxics of Concern" and reducing chemical releases throughout the Chesapeake Bay watershed. Pollution prevention (or P2) includes a hierarchy of activities and techniques to reduce or eliminate the amount and toxicity of chemicals used at the source of production and the amount of wastes generated. P2 was embraced by the Executive Council because many P2 techniques not only decrease chemical discharges and waste generation, but also result in increased production efficiency and reduced waste disposal costs for businesses. For this reason, business and industry have been the leaders in developing many pollution prevention techniques and are proponents of this voluntary approach to eliminating or reducing the generation of wastes.

Working closely with representatives from business and industry, the EPA Chesapeake Bay Program, DEQ Chesapeake Bay Program and Pollution Prevention staffs helped craft Businesses for the Bay, a voluntary pollution prevention program designed to encourage industry to adopt pollution prevention principles. The Executive Council approved the program in October 1996 and Virginia kicked off its program in January 1997.

Membership in Businesses for the Bay is open to all businesses and other facilities in the Bay watershed, including federal, state, and local government facilities. Each participating facility annually develops its own P2 goals and reports back on its progress of the previous year's efforts. Members not only benefit from cost savings and increased efficiencies, but also from positive publicity, increased patronage, and eligibility for various P2 grants and awards from the Executive Council.

Goals of the program include raising participation in pollution prevention activities to include 75% of all business in the Chesapeake Bay watershed by the year 2000; achieving an aggregate reduction in the amount of chemical releases across the Bay watershed for Toxic Release Inventory chemicals by at least 65% and Bay Toxics of Concern by 75% by the year 2000 (using 1988 as the baseline year); increasing the number of small business participants in pollution prevention; and increasing the number of pollution prevention mentors from the private sector.

During 1997, DEQ's Office of Pollution Prevention actively promoted the Businesses for the Bay program through a variety of approaches, including newsletter and newspaper features, numerous presentations, and direct mailings. As a result of these efforts, Virginia has successfully enrolled 56 program members. In addition, Businesses for the Bay was also the featured business component of the Governor's , an annual promotion of volunteer activities aimed at improving the quality of Virginia's water resources. As part of Fall River Renaissance, DEQ co-sponsored a day-long training workshop for businesses interested in becoming mentors to other business that lack pollution prevention experience and expertise.

All of the initiatives and programs discussed in this chapter have been designed to improve the quality of waters entering the Chesapeake Bay watershed. As previously stated, the primary goal of the Chesapeake Bay Program is to reduce the nutrient loadings entering the Bay by 40%. Likewise, toxic reduction strategies have been designed to help reduce the impact of toxic contaminants on the aquatic life in the Bay and its tributaries. Finally, the efforts to preserve and enhance wetland areas will also

benefit the continued health of aquatic life in the Bay area.

Chapter 3.6 WETLANDS ASSESSMENT and PROGRAM INITIATIVES

Virginia has approximately 1 million acres of wetlands. One quarter of these are tidal wetlands and three quarters are nontidal. Forested wetlands are the most common variety of nontidal wetlands in Virginia. Development in wetlands in Virginia is regulated by the Corps of Engineers through Section 404 permits; the Department of Environmental Quality, through Virginia Water Protection Permits and by the Virginia Marine Resources Commission and local Wetland Boards (tidal wetlands only).

It is estimated that Virginia has lost about 42% of its wetlands since the 1780's (Dahl, 1980). The estimated annual loss of all wetland types between 1955 and 1977 was 3000 acres per year (Tiner, 1987).

This loss of wetland areas has been recognized as being potentially detrimental to Virginia's environment and new ways of mitigating these losses are now being considered and enacted.

For example, several large projects impacting wetlands are under consideration in Virginia. King William Reservoir, if permitted, will impact 437 acres of non tidal wetlands. The project impacts to the wetland areas, as proposed, would be mitigated at a minimum of a two to one ratio. Other large projects under consideration are the Southeastern Virginia expressway in Virginia Beach and Chesapeake with roughly 200 acres of wetland impact and the expansion of the Southeastern Public Service Authority landfill with nearly 377 acres of nontidal impact.

Wetlands Management

Through the Wetlands Act of 1972 (Title 62.1 of the Code of Virginia), the Commonwealth of Virginia defined tidal wetlands for the purposes of protecting the resource and regulating development.

Under the Virginia definition, wetlands are found in the 29 counties and 17 cities that comprise Tidewater, Virginia. Specifically, vegetated wetlands are defined as "all land lying between and contiguous to mean low water and an elevation above mean low water equal to the factor 1.5 times the mean tide range at the site of the proposed project in the county, city or town in question," and on which are growing one or more of 37 specified species of wetlands vegetation. Non-vegetated wetlands are defined as all other lands between mean low water and mean high water. The Virginia Wetlands Act of 1972 does not include a definition for non-tidal wetlands. Further, it does not include all lands which are considered to be

wetlands under the federal definition, seasonally tidal areas included. Although the Wetlands Act was initially limited to vegetated tidal wetlands, subsequent amendments included two discrete areas subject to wind tides along the North Landing River and Back Bay in southeastern Virginia.

A definition of Virginia wetlands is contained in the DEQ's Wetlands Policy, as follows: "The wetlands of the Commonwealth, including marshes, swamps, bogs and other low-lying areas, which during some period of the year will be covered in part by natural non-flood waters, are unique, valuable and an irreplaceable natural resource." This definition was modified and included in the Virginia Water Protection Permit (VWPP) regulation (VR 680-15-02) as follows: "Wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and, under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas (VR 680-15-02).

Wetlands Legislation

Tidal Wetlands Act

The Virginia Tidal Wetlands Act of 1972 is codified in Title 28.2, Chapter 13, Code of Virginia, and is administered by the Virginia Marine Resources commission (VMRC). The Act authorizes local governments to establish local wetlands boards which exercise jurisdiction and issue permits for wetlands development, subject to adoption of a model wetlands zoning ordinance. The model ordinance is contained within the enabling legislation and, since Virginia is a "Dillon Rule" state, does not convey any

authority to the locality to be more stringent than the Commonwealth's.

To date, 31 of 46 eligible localities have established local wetland programs. In localities without wetlands boards, permits for wetlands development must be obtained from VMRC. The Commission reviews all decisions made by the local boards and has the authority to modify, remand, or reverse those decisions.

The Act also requires that the Virginia Institute of Marine Science (VIMS) maintain an inventory of vegetated wetlands and provide advice and assistance to the VMRC on projects and on the development of wetland guidelines. The guidelines describe the values of each wetland community type and provide ranking according to the values.

Chesapeake Bay Preservation Act

This legislation created the Chesapeake Bay Local Assistance Department, whose function is to protect water quality and the integrity of the Chesapeake Bay with the creation of Chesapeake Bay Preservation Areas through local government ordinances. These preservation areas serve to restrict development in wetlands associated with free flowing permanent streams and establish buffer zones for these areas. The implementation of the regulations of this Act relies on local governments. The mapping of Virginia's wetlands for this effort is currently being conducted by the DCR-DSWC. This effort has received funding from the General Assembly to map those wetlands not covered by the U. S. Fish and Wildlife Service's Wetlands Inventory.

Virginia Water Protection Permit (VR 680-15-02)

VWPP constitutes the state Water Quality Certification required under section 401 of the Clean Water Act. A VWPP would be issued for an activity requiring section 401 certification if it has been determined that the proposed activity is consistent with the provisions of the Clean Water Act and will protect instream beneficial uses. Activities for which a water quality certificate, and therefore, a VWPP, are required include impacts to wetlands under section 404 of the Act, Section 10 of the Rivers and Harbors Act of 1899, Federal Energy Regulatory Commission licensing, and other appropriate federal permits or licenses.

Regulations for the VWPP were promulgated on May 20, 1992. These regulations replaced the existing 401 regulatory procedures as was contained in the SWCB's Procedural Rule No. 3.

Definition of State Waters

The Virginia Water Protection Regulations (VR 680-15-02) define "surface waters", which are part of the definition of state waters, to include wetlands. This definition has closely followed the federal definition of "waters of the U.S."

Coordination of Activities

Several state agencies are involved in reviewing activities for which permits may be needed. Among these agencies are the DGIF and DCR-Division of Natural Heritage, which have an interest in aquatic or wetland-dependent species and their habitat. Additionally, the VMRC regulates activities in tidal wetlands and acts as the clearing house for all permit applications. Permitting activities are coordinated with these agencies during cooperative site visits and periodic Joint Permit Application meetings sponsored by the Corps of Engineers.

Wetland Protection Activities

The Commonwealth of Virginia, through the VWPP, applies its authority under section 401 of the Clean Water Act to the following activities:

Section 10 Rivers and Harbors Act
Section 402 Clean Water Act; Homogenous fill
Section 404 Clean Water Act
Federal Energy Regulatory Commission licensing and relicensing projects

Nationwide permits were recertified on January 21, 1992 by the SWCB. Three Nationwides (7, 16, and 17) were denied water quality certification for activities involving intake or outfall structures, return water from upland disposal sites, and FERC hydropower projects, respectively. Two Nationwide permits were conditionally certified. These two nationwides relate to minor road crossings and activities in headwaters and isolated wetlands, and contain language that insures that individual certification may be modified if they prove to be inadequate. With the promulgation of the VWPP regulations, the agency has taken the position that this water quality certification is still in effect.

Since implementation of the VWPP regulations, the state has entered into an agreement with the USDA-SCS, the Corps, VMRC, DGIF and other state agencies, concerning the use of Nationwide 37 (Flood Emergency Projects) which is designed to streamline site review and decision-making while insuring that water resources (including wetlands) are adequately protected.

Nationwide Permit Number 29 for wetland impacts caused by single family homes was conditionally certified in Virginia. This general permit cannot be used to fill in perennial streams, lakes, rivers or other open water bodies.

On July 1, 1995 implementation of the Virginia Water Protection Permit/Section 401 Water Quality Certification was transferred to DEQ's Regional Offices for most types of permits. Exceptions include state highway projects and projects which impact instream flow.

In 1996, the Virginia General Assembly enacted legislation to encourage the use of Wetland Mitigation Banks. These "banks" must be developed in accordance with federal guidance for the creation of wetland mitigation banks. Furthermore, the Virginia General Assembly enacted service area requirements for these banks that required any impacts be in the same hydrologic unit or in an adjacent unit to the bank.

The Great Dismal Swamp Wetland Mitigation Bank is the first new wetland mitigation bank in Virginia to be created subsequent to the issuance of the new Federal Guidance. This bank, mostly in North Carolina, will preserve or restore 8000 acres of wetlands.

In February 1997, the Commonwealth reestablished its position on Section 401 water quality certification relative to the reissued Corps Nationwide Permits. The State maintained its ability to issue individual permits for projects, authorized under Nationwide Permit Number 26, which impact more than one acre of headwater wetlands. This is the same threshold that was in effect with the previous round of Nationwide Permits issued in 1992.

Also in 1997, the State Water Control Board, in conducting its triennial review of water quality standards, created for the first time, a separate category of surface waters defined as "wetlands". This designation will allow for regulatory protection, as it pertains to water quality associated with designated uses, primarily aquatic life use and swimming and secondary contact recreation use.

The Commonwealth of Virginia, as a state signatory to the Chesapeake Bay Wetlands Policy in 1989, is committed to attaining a net gain in wetlands acreage and functions within the Chesapeake Bay drainage. The newly elected Governor has also committed to achieving a net gain in wetlands during his tenure as Governor.

With these initiatives, the Commonwealth looks to protect its wetlands as they currently exist and will seek to create and protect additional wetland areas within the state.

Chapter 4.1 GROUND WATER PROTECTION PROGRAMS

Ground water programs in Virginia strive to maintain existing high water quality through adopted statutes, regulations, and policies. Advancing ground water protection efforts is the goal of many state programs in numerous state agencies. In late 1986 an interagency committee was formed to stimulate, strengthen, and coordinate ground water protection activities in Virginia. The Ground Water Protection Steering Committee (GWPSC) continues to meet bi-monthly with representation from the following agencies:

Department of Environmental Quality (DEQ)
Department of Health (VDH)
Chesapeake Bay Local Assistance Department (CBLAD)
Department of Mines, Minerals, and Energy (DMME)
Virginia Polytechnic and State University (VPI&SU)
Department of Housing and Community Development (VDH&CD)
Department of Agriculture and Consumer Services (VDACS)
Department of Conservation and Recreation (DCR)
Department of General Services, Division of Consolidated Laboratories (DCLS)
Department of Business Assistance (DBA)
US Geologic Survey (USGS)

The following paragraphs briefly describe ground water protection activities at member agencies. Information provided in Tables 4.1-1, 4.1-2, 4.1-3 and 4.1-4 is presented for the Commonwealth as a whole. System upgrades at the VDH prevented manipulation of listed parameters and detections/violations for public water supply data. In addition, budgetary constraints within the Commonwealth prevent coordinated data collection activities designed to characterize ambient ground water quality and changes to that quality over time on a statistically valid statewide basis.

Wellhead Protection Efforts

Building grassroots support for ground water and wellhead protection continue to be priorities of the GWPSC. Accomplishments during this reporting period include the development and distribution of a publication on wellhead protection activities in the Commonwealth (Wellhead Protection: Case Studies of Six Local Governments in Virginia), hosting three one-day workshops, and the voluntary completion of two Biennial Wellhead Protection Reports (see Table 4.1-1). Future efforts will include cooperating with the Virginia Department of Health on source water protection issues. Funding for GWPSC activities, including wellhead protection, is provided through DEQ's Federal Ground Water Protection Grant.

**Table 4.1-1 Public Water Supply Systems and Population Served
from Virginia's 1997 Biennial Wellhead Protection Report**

Total Number of Public Water Supply (PWS) systems	4,003
Total Number of GW-Dependent PWS Systems	3,711
Total Number of Community Water Supply Systems	1,400
Total Number of GW-Dependent Community Water Supply Systems	1,132
Total Population Relying on Community Water Supply Systems	6,224,601
Total Population Relying on GW-Dependent Community Water Supply Systems	668,764

Total Number of GW-Dependent Non-Transient Non-Community PWS Systems	638
Total Number of GW-Dependent Transient Non-Community PWS Systems	1,942

Ground Water Management Act of 1992

The 1992 session of the Virginia General Assembly adopted the Act and repealed the Ground Water Act of 1973. The Act establishes criteria for the creation of ground water management areas and requires person who withdraw more than 300,000 gallons of ground water per month to obtain permits. The Act requires that previously exempted agricultural ground water withdrawals obtain ground water withdrawal permits. The DEQ adopted regulations to implement the Act in September of 1993. This regulation is currently in the process of amendment to include specific requirements for agricultural ground water withdrawal permits and to require DEQ to perform technical evaluations of proposed withdrawals.

Underground Storage Tank (UST) Program

The DEQ currently maintains records on some 74,000 regulated USTs at 25,000 facilities in Virginia. The UST program maintains a computer database of all UST information and tracks the reporting of installations, upgrades, repairs, and closures. Local building/fire officials assist the program by permitting UST activities statewide. Compliance monitoring is performed on a periodic basis and includes computer searches, outreach through presentations and informational mailings, compliance mailings, and random site inspections. By December 22, 1998 all existing (pre-1988) USTs must be upgraded to new tank standards, replaced, or closed. The DEQ conducted 6,000 UST inspections during 1997 to inform owners of this deadline. Federal grant funds and matching State funds support this program.

Leaking Underground Storage Tank (LUST) Program

The LUST side of the UST program is involved in overseeing leaks from underground storage tanks. Regional Office Ground Water staff perform initial investigations and direct owners/operators to take appropriate remediation activities. Regional Office staff review all required reports and issue corrective action plan (CAP) permits as needed. Central office staff provide audit/review of regional office approved site characterization (SCR) reports and CAPs and assist the regional staff as necessary. To assist owners and operators with UST releases, the tank program maintains procedures for UST owners/operators to obtain reimbursement for certain corrective action costs and third party claims through the Virginia Petroleum Storage Tank Fund (VPSTF). A combination of Federal LUST Trust Funds and VPSTF monies are used to implement this effort.

In cases where owners/operators cannot be identified or are unable to act effectively the DEQ LUST staff utilize a private contractor to investigate and cleanup. The LUST staff also manages the alternate water supply (AWS) effort and provides technical review of reimbursement requests for reimbursing owners/operators who have spent more than their limit of financial responsibility.

Aboveground Storage Tank (AST) Program

The DEQ has proposed a new regulation that will consolidate three existing regulations and aid DEQ efforts to eliminate duplication in regulations, provide uniformity in regulation, streamline government services, and increase performance and efficiency. The existing regulations relate to the 9,968 presently registered ASTs/facilities located in the Commonwealth that have an individual AST capacity of 660 gallons or an aggregate facility capacity of 1,230 gallon or more of oil. Proposed additions to the regulations will establish criteria for granting variances from the AST Pollution Prevention Requirements and will allow DEQ to evaluate and take the necessary steps to accept US

Coast Guard and EPA approved response plans either wholly or with state specific information added. Registration fees, "Oil Discharge Contingency Plan" fees, and State funds support the AST program.

Waste Permitting Activities

The Resource Conservation and Recovery Act (RCRA) Base Program addresses ground water quality issues at both permitted and unpermitted land-based units. Information provided in Table 4.1-3 RCRA Corrective Action category is for non Hazardous and Solid Waste Amendment (HWSA) sites and is divided into two sectors. The term "sites" refers to facilities; most facilities have more than one regulated unit. There are a total of 47 units among the 29 facilities. The "Base Program Correction Action" sites or "Little C" sites are permitted units required to perform corrective action if the ground water concentrations exceed established Ground Water Protection Standards. The second sector is "Unpermitted Land Disposal Facilities (LDF)" where continued operation of the facility is contingent upon removal or decontamination of contaminated media. In instances where the LDF is closed, ground water monitoring is required to demonstrate that closure performance standards are met. When standards are not met, the site is issued a Post Closure Permit and corrective action is undertaken.

Included in Table 4.1-3 are ground water contamination statistics from the DEQ's Federal Facilities Restoration and Superfund Office. The Federal Facilities Restoration activities include Department of Defense (DOD) installations (Army, Navy, Air Force, Defense Logistics Agency, and Formerly Used Defense Sites) and a NASA installation for a total of 33 installations. Currently eight Federal Facilities are listed on the National Priority List (NPL) and 25 non-NPL sites. Base Realignment and Closure is occurring at seven facilities. Federal funding from the Department of Defense supports the Federal Facilities Restoration program. The Superfund Program, funded with both Federal and State dollars, carries out activities required by law or legal agreements at 20 NPL sites. Two of these sites have now been cleaned up and delisted. Additional activities within this Office include DEQ's Voluntary Remediation Program and the Brownfields Program. The Voluntary Remediation Program provides a mechanism for eligible participants to voluntarily clean up properties not mandated for remediation under existing environmental laws. This program serves as a mechanism for cleanup of Brownfield sites. There are currently 75 Brownfield sites that are either potential candidates for clean up, formally in the program or have been cleaned up under the program. A combination of registration fee and EPA funding supports the Voluntary Remediation Program. The DEQ's Brownfields Program, funded through EPA, is currently under development. None of these four programs currently collect ground water quality data; they do receive and review data collected by outside sources.

Pesticide Disposal Program

The VDACS, in cooperation with the Virginia Pesticide Control Board, has conducted a highly popular Pesticide Disposal Program since 1990. As of October, 1997 more than 240 tons of unwanted pesticides have been collected from 1455 agricultural producers, pesticide dealers and commercial pest control firms located in 83% of Virginia's counties and independent cities and disposed of safely. Collection and disposal of agricultural pesticides will be carried out in the remaining counties in 1998. The pesticide disposal program has benefitted from a high level of interagency cooperation among the VDACS, DEQ, DCR, DCLS, and Virginia Cooperative Extension. Funding to support this program has been pooled from Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Clean Water Act (Sections 319 Non Point Source and 106 Ground Water Protection) grants and the Office of Pesticide Services program fees.

Pesticide and Ground Water Management Plan

In response to the EPA Pesticides and Ground Water Strategy, the VDACS formed a task force in 1992. This committee comprised of representatives from the water user community, four representatives from the GWPSC, four representatives from the agricultural community, a member from the Board of Agriculture and one from the Virginia Pesticide Control Board. The objective of the

task force was to draft a Generic State Management Plan (GSMP) for pesticides and ground water. GSMP development was cooperatively funded by the VDACS, DCR, and DEQ through EPA FIFRA, Clean Water Act (Sections 319 Non Point Source and 106 Ground Water Protection) grants. The completed GSMP was submitted to EPA Region III in 1993 and received EPA concurrence in 1995. The GSMP established a graduated response plan for pesticides detected in ground water, a process for developing pesticide specific management plans (PSMP) should such be required by anticipated federal rule making and a graduated response approach for managing pesticides identified as potential threats to ground water.

Pesticides in Ground Water Monitoring Project

In preparation for implementation of PSMPs, the VDACS initiated a pilot monitoring project in September, 1994 and completed in March, 1996. A total of 49 shallow bored wells were sampled in eight localities. Samples were analyzed for alachlor, atrazine, cyanazine, metolachlor, simazine and nitrates. At least one pesticide was detected in nine of the wells. One well exceeded the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act for alachlor (2 ppb) with a detection of 9 ppb. Thirty four wells had detectable levels of nitrate. Seven wells exceeded the MCL established under the Safe Drinking Water Act of 10 ppm. The highest level of nitrate was 17.2 ppm.

CIBA Atrazine Monitoring Study

The VDACS cooperated in a Atrazine Monitoring Study with CIBA Ag Chemicals in 1994. Under this study, 64 drinking water wells were sampled and analyzed for atrazine, simazine, prometon, propazine, ametryn, prometryn, metalaxyl, metolachlor, cyanazine, three metabolites of atrazine, and nitrates. At least one pesticide was found in 19 wells. However, concentrations were generally very low. No wells had pesticide residues at or above the MCL. Fifty three wells had detectable levels of nitrate and sixteen of these wells had levels of nitrates at or above the MCL of 10 ppm.

Cat Point Creek Watershed-Shallow Ground Water Monitoring

The DCR, in cooperation with the Tidewater Resource Conservation and Development Council, initiated a ground water monitoring study in the Cat Point Creek watershed in December, 1995. Land use in the watershed is dominated by rowcrop agriculture, grasslands, and forestry. The purpose of this ground water study was to begin a multiple-year process to evaluate the effectiveness of integrated crop management (ICM) in reducing the loading of nitrate and pesticides to the shallow water-table aquifer. ICM incorporates nutrient management and pest management into one plan to be followed by producers. In this study, two producers implemented ICM at three different study sites (sites 1-3) beginning in the spring of 1996. A well cluster, consisting of three wells per cluster, was established in each of the ICM fields and in the control fields. Ground water samples for nutrients were collected twice a month between February and July and on a monthly basis for all other months. Pesticide samples were collected in May and November of 1996. Atrazine was the only pesticide detected in ground water and it was only found in samples collected at the ICM and control fields at site 1 in May, 1996. Pesticides were not detected in any of the November, 1996 samples. Ground water monitoring activities were funded through the DEQ's Federal 106 Ground Water Protection Grant.

Polecat Creek Watershed-Shallow Ground Water Monitoring

The CBLAD initiated ground water monitoring for nitrates as part of the Polecat Creek Watershed project in June 1997. Activities are funded by the Clean Water Act, Section 319 Non Point Source grant funds. The USGS is conducting the ground water monitoring in Caroline County. There are two well transects installed adjacent to agricultural land uses. Pending grant applications include expanding the well transects to residential, commercial, and forested areas. The USGS will be determining flow periods, history, and chemistry for ground water in this watershed and, ultimately,

attempting to learn if pollution is flowing into surface waters through ground water.

Ground Water Protection Program Conclusion

Ground water programs in Virginia strive to maintain the existing high water quality. The Virginia Ground Water Protection Steering Committee (GWPSC), established in 1986, continues to meet bi-monthly as a vehicle for sharing information, for directing attention to important ground water issues, and for taking the lead on ground water protection initiatives requiring an inter-agency approach. This inter-agency advisory committee is designed to stimulate, strengthen, and coordinate ground water protection activities in the Commonwealth. Ground water protection activities in the Commonwealth are as varied as the funding sources that support them.

Table 4.1-2 Major Sources of Ground Water Contamination

Contaminant Source	Ten Highest-Priority Sources(√) ⁽¹⁾	Factors Considered in Selecting a Contaminant Source ⁽²⁾	Contaminants ⁽³⁾
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications	√	(F) State GW Protection Strategy	(E)
Irrigation practices			
Pesticide applications	√	(F) State GW Protection Strategy	(A,B)
Storage and Treatment Activities			
Land application	√	(F) State GW Protection Strategy	(E)
Material stockpiles			
Storage tank (above ground)			
Storage tank (underground)	√	(F) State GW Protection Strategy	(D)
Surface impoundments	√	(F) State GW Protection Strategy	(E)
Waste piles			
Waste tailings			
Disposal Activities			
Deep injection wells			
Landfills	√	(F) State GW Protection Strategy	(M) 40 CFR-App IX
Septic systems	√	(F) State GW Protection Strategy	(J)
Shallow injection wells			
Other			
Hazardous waste generators			
Hazardous waste sites			
Industrial facilities			
Material transfer operations			
Mining and mine drainage	√	(F) State GW Protection Strategy	(M) Acid Leachate
Pipeline and sewer lines			
Salt storage and road salting			
Salt water intrusion	√	(F) State GW Protection Strategy	(G)
Spills			
Transportation of materials			
Urban runoff	√	(F) State GW Protection Strategy	(M) NPS pollutants such as fertilizers & heavy metals
Other sources (please specify)			

A-Inorganic Pesticides
 B-Organic Pesticides
 C-Halogenated Solvents
 D-Petroleum Compounds

H-Metals
 I-Radionuclides
 J-Bacteria
 K-Protozoa

Table 4.1-3 Summary of State Ground Water Protection Programs

Programs or Activities	Check* (√) ⁽¹⁾	Implementation Status ⁽²⁾	Responsible State Agency(3)
Active SARA Title III Program	√	fully-estab.	DEQ
Ambient ground water monitoring system			
Aquifer vulnerability assessment	√	under devel.	VDCR
Aquifer mapping			
Aquifer characterization			
Comprehensive data management system			
EPA-endorsed Core Comprehensive State Ground Water Protection Program (CSGWPP)			
Ground water discharge permits (VPA)	√	fully-estab.	DEQ
Ground water Best Management Practices			
Ground water legislation (Quantity)	√	fully-estab.	DEQ
Ground water classification			
Ground water quality standards	√	fully-estab.	DEQ
Interagency coordination for ground water protection initiatives	√	fully-estab.	DEQ
Nonpoint source controls	√	cont. efforts	VDCR
Pesticide State Management Plan (Generic)	√	fully estab.	VDACS
Pollution Prevention Program			
Resource Conservation and Recovery Act (RCRA) Primacy	√	fully-estab.	DEQ
Source Water Assessment Program		under development	VDH
State Superfund	√	under revision	DEQ
State RCRA Program incorporating more stringent requirements than RCRA Primacy			
State septic system regulations	√	fully-estab.	VDH
Underground storage tank installation requirements	√	fully-estab.	DEQ
Underground Storage Tank Remediation Fund	√	fully-estab.	DEQ
Underground Storage Tank Permit Program	√	fully-estab.	DEQ
Underground injection Control Program			
Vulnerability assessment for drinking water/wellhead protection			
Well abandonment regulations	√	fully-estab.	VDH
Wellhead Protection Program (EPA-approved)			
Well Installation regulations		fully estab.	VDH

Table 4.1-4 Ground Water Contamination Summary

Aquifer Description Commonwealth of Virginia
 Data Reporting Period 7/92 - 6/97

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed groundwater contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of Sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL		20	20	14	(A)					
CERCLIS (non-NPL)		200+								
DOD/DOE (NPL) - (NPL)		8	8	8	(B)					
DOD/DOE(nonNPL)		25	25	15						
LUST		7,575	7,575		petroleum hydrocarbons					
RCRA Corrective Action	PERMITTED	12	11	11	40CFR APP IX	12	1	5	2	0
	UNPERMITTED	17	12	12	40CFR APP IX	17	0	-	0	0
Underground Injection										
State Sites										
Nonpoint Sources										
Other (specify)										

Source Type Abbreviations

NPL - National Priority List
 CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
 DOE - Department of Energy
 DOD - Department of Defense
 LUST - Leaking Underground Storage Tanks
 RCRA - Resource Conservation and Recovery Act

Contaminant Type

(A) listed and characteristic hazardous waste
 (B) metals, halogenated organics, POL,PCB, Pesticides

APPENDIX A

CLEAN WATER ACT SECTIONS

Sec. 305. Water Quality Inventory

(b)(1) Each State shall prepare and submit to the Administrator by April 1, 1975, and shall bring up to date by April 1, 1976, and biennially thereafter, a report which shall include-- (A) a description of the water quality of all navigable waters in such State during the preceding year, with appropriate supplemental descriptions as shall be required to take into account seasonal, tidal, and other variations, correlated with the quality of water required by the objective of this Act (as identified by the Administrator pursuant to criteria published under section 304(a) of this Act) and the water quality described in subparagraph (B) of this paragraph; (B) an analysis of the extent to which all navigable waters of such State provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water; (C) an analysis of the extent to which the elimination of the discharge of pollutants and a level of water quality which provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allows recreational activities in and on the water, have been or will be achieved by the requirements of this Act, together with recommendations as to additional action necessary to achieve such objectives and for what water such additional action is necessary; (D) an estimate of (i) the environmental impact, (ii) the economic and social costs necessary to achieve the objective of this Act in such State, (iii) the economic and social benefits of such achievement, and (iv) an estimate of the date of such achievement; and (E) a description of the nature and extent of nonpoint sources of pollutants, and recommendations as to the programs which must be undertaken to control each category of such sources, including an estimate of the costs of implementing such programs. (2) The Administrator shall transmit such State reports, together with an analysis thereof, to Congress on or before October 1, 1975, and October 1, 1976, and biennially thereafter.

Grants for Sec. 106. Pollution Control Program

(e) Beginning in fiscal year 1974 the Administrator shall not make any grant under this section to any State which has not provided or is not carrying out as a part of its program -- (1) the establishment and operation of appropriate devices, methods,, systems, and procedures necessary to monitor , and to compile and analyze data on (including classification according to eutrophic condition), the quality of navigable waters and to the extent practicable, ground waters including biological monitoring; and provision for annually updating such data and including it in the report required under section 305 of this Act;

Sec. 204. Limitations and Conditions

(a) Before approving grants for any project for any treatment works under section 201(g)(1) the Administrator shall determine -- "that (A) the State in which the project is to be located (i) is implementing any required plan under section 303(e) of this Act and the proposed treatment works are in conformity with such plan, or (ii) is developing such a plan and the proposed treatment works will be in conformity with such plan, and (B) such State is in compliance with section 305(b) of this Act;"

Sec. 314. Clean Lakes

(a) Each State shall prepare or establish, and submit to the Administrator for his approval --

"(A) an identification and classification according to eutrophic condition of all publicly owned lakes in such State; "(B) a description of procedures, processes, and methods (including land use requirements), to control sources of pollution of such lakes; "(C) a description of methods and procedures, in conjunction with appropriate Federal agencies, to restore the quality of such lakes; "(D) methods and procedures to mitigate the harmful effects of high acidity, including innovative methods of neutralizing and restoring buffering capacity of lakes and methods of removing from lakes toxic metals and other toxic substances mobilized by high acidity; "(E) a list and description of those publicly owned lakes in such State for which uses are known to be impaired, including those lakes which are known not to meet applicable water quality standards or which require implementation of control programs to maintain compliance with applicable standards and those lakes in which water quality has deteriorated as a result of high acidity that may reasonably be due to acid deposition; and "(F) an assessment of the status and trends of water quality in lakes in such State, including but not limited to, the nature and extent of pollution loading from point and nonpoint sources and the extent to which the use of lakes is impaired as a result of such pollution, particularly with respect to toxic pollution.

"(2) SUBMISSION AS PART OF 305(b)(1) REPORT.--The information required under paragraph (1) shall be included in the report required under section 305(b)(1) of this Act, beginning with the report required under such section by April 1, 1988

Potomac - Shenandoah River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG & W I O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA														SEDIMENT		FISH TISSUE				BIO MON	TYPE BIOL STN	COMMENTS	
	IDENTIFICATION NUMBER	TYPE	TEMP	RESUL	D.O.	pH	RESUL	TOX	PHOS	RESUL	CHL	PHOS	RESUL	COL	BACT	#b	#c	#d	#e	#f	#g	RESUL	RESUL	RESUL	RESUL	RESUL	RESUL	RESUL				RESUL
V-B01R	1ASTF006.12	A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S										
V-B02R	1ASOA001.00	A	1 / 9	J	0 / 9	J	0 / 9	J	0 / 8	J	/	/	0 / 8	J	/	/	/	/	1	S	0	S								Ni Bio Station not imp.		
V-B02R	1ASTC000.02	A	1 / 9	J	0 / 9	J	1 / 9	J	0 / 8	J	/	/	1 / 8	J	/	/	/	/	0	S	0	S										
V-B02R	SOA 1.00	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											NI	REF		
V-B02R	STC1 4.27	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											NI	NET		
V-B02R	STC2 0.92	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	REF		
V-B02R	WSC1 3.8	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											SI	SS		
V-B02R	WSC2 3.67	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											VI	SS		
V-B03R	1ASFP002.56	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 4	J	1 / 3	J	1 / 3	J	1 S	0 S														VI	SS	
V-B04R	1ABAB004.54	A	0 / 3	J	0 / 3	J	0 / 3	J	0 / 2	J	/	/	0 / 2	J	/	/	0	S	0	S	0	S										
V-B05R	1ABAR047.26	A	2 / 9	J	0 / 9	J	0 / 9	J	0 / 8	J	/	/	0 / 7	J	/	/	0	S	0	S	0	S										
V-B06R	1AHOC006.23	A	6 / 21	P*	0 / 21	S	0 / 21	S	1 / 19	S	/	/	1 / 19	S	/	/	0	S	0	S	0	S										
V-B07R	1ASLP034.20	A	0 / 3	J	0 / 3	J	0 / 3	J	0 / 2	J	/	/	0 / 2	J	/	/	0	S	0	S	0	S										
V-B08R	1AOPE036.13	A	0 / 60	S	0 / 60	S	0 / 60	S	1 / 59	S	/	/	11 / 58	P	/	/	0	S	0	S	0	S										
V-B08R	OPE1a 34.53	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											SI	REF		
V-B09R	1AABR000.78	A	0 / 60	S	0 / 60	S	0 / 60	S	1 / 59	S	/	/	10 / 58	P	/	/	0	S	0	S	0	S										
V-B09R	1ALIR000.95	A	0 / 21	S	0 / 21	S	0 / 21	S	1 / 19	S	/	/	2 / 19	T	/	/	0	S	0	S	0	S										
V-B09R	1AOPE025.10	A	0 / 60	S	0 / 60	S	0 / 60	S	28 / 60	T	/	/	7 / 59	S	/	/	0	S	0	S	0	S										
V-B09R	1ARED000.46	A	3 / 21	S	0 / 21	S	0 / 21	S	1 / 19	S	/	/	1 / 20	S	/	/	0	S	0	S	0	S										
V-B09R	ABR 0.77	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	NET		
V-B09R	OPE2 29.61	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	NET		
V-B10R	1BMDL061.07	A	0 / 22	S	0 / 22	S	0 / 22	S	2 / 21	S	/	/	8 / 20	P	/	/	0	S	0	S	0	S										
V-B10R	MDL 66.05	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	SS		
V-B10R	MDL 66.47	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	SS		
V-B10R	CSB	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											VI	SS		
V-B11R	1BJEN002.46	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 8	J	/	/	0 / 8	J	/	/	0	S	0	S	0	S										
V-B12R	1BLEW002.91	A	0 / 59	S	0 / 59	S	1 / 58	S	0 / 58	S	/	/	36 / 58	N	/	/	0	S	0	S	0	S										
V-B12R	1BMDL036.08	A	0 / 60	S	0 / 60	S	0 / 60	S	0 / 59	S	/	/	6 / 59	S	/	/	0	S	0	S	0	S										
V-B12R	LEW 6.95	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	NET		
V-B12R	MDL1 36.1	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											SI	NET		
V-B13R	1BMFT006.20	A	0 / 22	S	0 / 22	S	0 / 22	S	0 / 21	S	/	/	7 / 20	P	/	/	0	S	0	S	0	S										
V-B13R	MFT 6.24	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	NET		
V-B14R	1BCST012.32	A	0 / 59	S	0 / 59	S	0 / 59	S	8 / 59	S	/	/	21 / 55	N	/	/																
V-B14R	1BCST021.76	A	0 / 51	S	0 / 50	S	0 / 52	S	0 / 48	S	/	/	30 / 48	N	/	/	0	S	0	S	0	S										
V-B14R	CST 7.42	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	NET		
V-B14R	LOM 0.24	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	NET		
V-B14R	RIV HDS SCL STP	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S	0	S	0	S				
V-B15R	1BLNV000.21	A	0 / 14	S	0 / 14	S	0 / 14	S	1 / 14	S	/	/	1 / 14	S	/	/																
V-B15R	1BMDL001.83	A	0 / 60	S	0 / 59	S	0 / 60	S	0 / 55	S	/	/	10 / 54	P	/	/	0	S	0	S	0	S										
V-B15R	1BPCD000.20	A	0 / 2	J	0 / 2	J	0 / 2	J	0 / 3	J	/	/	2 / 3	T	/	/																
V-B15R	1BPCD001.03	A	0 / 49	S	0 / 47	S	0 / 50	S	1 / 45	S	/	/	26 / 44	N	/	/	0	S	0	S	0	S									STATION MOVED TO 1.03	
V-B15R	MDL 1.85	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											SI	NET		
V-B16R	1BNTH036.96	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 3	J	/	/	0 / 3	J	/	/	0	S	0	S	0	S								SI	NET	
V-B16R	NTH 46.75	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											SI	NET		
V-B17R	1BNTH021.00	A	0 / 59	S	0 / 58	S	0 / 60	S	1 / 57	S	/	/	18 / 57	P	/	/	0	S	0	S	0	S										
V-B17R	1BNTH030.35	A	0 / 18	S	0 / 18	S	1 / 17	S	0 / 17	S	/	/	3 / 16	T	/	/	0	S	0	S	0	S										
V-B18R	1BBRY006.94	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 3	J	/	/	0 / 3	J	/	/	0	S	0	S	0	S										
V-B18R	1BBVR003.60	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 3	J	/	/	2 / 3	T	/	/	0	S	0	S	0	S										
V-B18R	BVR13.6	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											SI	NET		
V-B18R	BVR22.75	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											SI	NET		
V-B18R	BUF 2.18	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/											MI	NET		
V-B19R	1BMSS001.35	A	3 / 52	S	0 / 50	S	0 / 53	S	0 / 49	S	/	/	29 / 49	N	/	/	0	S	0	S	0	S										

Potomac - Shenandoah River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG W & B ION D	MONITORING STATIONS	TYPE	CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT				FISH TISSUE				BIO MON	TYPE BIOL STN	COMMENTS			
			# VIOLATIONS / # SAMPLES						TOL ALPS	PHOR OSUL	RCH LOPH OLa	RCL ITFOR MA	BACT TERI UL	#b EXTC AELE SD	#c RCS UL AE ND	#d EXTC AELE SD	#e RCS UL AE ND	#f EXTC AELE SD	#g RCS UL AE ND													
			TEMP	RES UL	D.O.	RES UL	pH	RES UL																								
V-B19R	MOS 3.01	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	
V-B20R	1BDUR010.66	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 3	J	/	/	/	0 / 3	J	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B21R	1BDUR000.02	A	0 / 49	S	0 / 49	S	0 / 49	S	3 / 54	S	/	/	/	19 / 50	N	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B21R	1BDUR007.66	A	2 / 17	T	0 / 17	S	1 / 17	S	0 / 15	S	/	/	/	1 / 15	S	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B21R	DUR 0.06	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	
V-B22R	1BMDD000.40	A	0 / 60	S	0 / 59	S	0 / 60	S	10 / 64	S	/	/	/	43 / 62	N	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B22R	1BMDD005.81	A	0 / 47	S	0 / 47	S	0 / 47	S	7 / 50	S	/	/	/	33 / 48	N	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B22R	MDD 2.1	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	
V-B22R	MDD 5.81	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	
V-B23R	1BNTH014.08	A	0 / 60	S	0 / 60	S	0 / 60	S	27 / 60	T	/	/	/	23 / 59	N	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B23R	NTH 1 16.45	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	REF	
V-B23R	NTH 2 14.48	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	
V-B23R	NTH002.28	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B24R	1BLGC000.96	A	0 / 3	J	0 / 3	J	0 / 3	J	0 / 3	J	/	/	/	2 / 3	J	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B25R	1BCKS003.10	A	0 / 53	S	0 / 53	S	0 / 53	S	20 / 53	T	/	/	/	48 / 54	N	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B25R	CFP 2.54	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	An
V-B26R	1BBLK000.38	A	0 / 52	S	0 / 52	S	0 / 52	S	5 / 52	S	/	/	/	37 / 52	N	/	/	1 T	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B26R	BLK 5.62	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	NET	
V-B27R	1BPLR000.16	A	0 / 47	S	0 / 47	S	0 / 47	S	7 / 47	S	/	/	/	42 / 48	N	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B27R	PLR 0.08	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
V-B28R	1BNKD000.80	A	0 / 51	S	0 / 50	S	0 / 52	S	0 / 49	S	/	/	/	26 / 49	N	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		
V-B29R	1BMIC001.00	A	0 / 48	S	0 / 48	S	0 / 48	S	2 / 48	S	/	/	/	29 / 49	N	/	/	1 T	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B29R	MIC 1.00	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	Zn
V-B30R	1BSTH041.68	A	0 / 52	S	0 / 50	S	0 / 52	S	0 / 48	S	/	/	/	17 / 47	N	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B30R	CLS003.60	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		
V-B31R	1BCK000.78	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 19	S	/	/	/	0 / 18	S	/	/	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S		
V-B32R	1BSTH007.80	A	0 / 60	S	0 / 59	S	0 / 61	S	0 / 56	S	/	/	/	3 / 56	S	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B32R	1BSTH027.85	A	0 / 60	S	0 / 60	S	1 / 60	S	1 / 59	S	/	/	/	6 / 54	S	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B32R	PAI 2.7	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	REF	
V-B32R	STH1 27.08	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	
V-B32R	STH3 21.72	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	
V-B32R	STH024.70	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S		
V-B33R	1BSSF100.10	A	0 / 59	S	0 / 58	S	0 / 60	S	0 / 56	S	/	/	/	7 / 55	S	/	/	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S		
V-B33R	SSF1 100.1	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		
V-B34R	1BCBR000.80	A	0 / 21	S	0 / 21	S	1 / 21	S	1 / 19	S	/	/	/	5 / 18	P	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B35R	1BBON000.60	A	0 / 9	J	0 / 9	J	0 / 9	J	1 / 8	J	/	/	/	2 / 8	J	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B35R	HKS1 2.23	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	NET	
V-B35R	QAL1 5.18	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	NET	
V-B35R	QAL2 5.03	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	
V-B35R	QAL3 4.47	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	
V-B35R	SSF2 78.20	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	
V-B35R	SSF079.78	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		
V-B36R	1BNAK001.24	A	0 / 9	J	0 / 9	J	0 / 9	J	0 / 8	J	/	/	/	0 / 8	J	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B36R	NAK 1.24	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	
V-B37R	1BCUB000.40	A	0 / 50	S	0 / 50	S	0 / 50	S	0 / 51	S	/	/	/	3 / 51	S	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B37R	1BSSF078.20	A	0 / 59	S	0 / 59	S	0 / 59	S	4 / 59	S	/	/	/	6 / 58	S	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B37R	SSF065.57	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S		
V-B37R	SSF068.16	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S	0 S		
V-B38R	1BMLC000.40	A	0 / 50	S	0 / 50	S	0 / 49	S	1 / 51	S	/	/	/	25 / 51	N	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B38R	1BSSF054.20	A	0 / 59	S	0 / 59	S	0 / 59	S	5 / 59	S	/	/	/	6 / 58	S	/	/	0 S	0 S	0 S	0 S	/	/	/	/	/	/	/	/	/		
V-B38R	1BSSF065.57	A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		
V-B38R	BIG 1.80	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/td							

Potomac - Shenandoah River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG & W I O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT				FISH TISSUE				BIO MON	TYPE BIOL STN	COMMENTS				
	IDENTIFICATION NUMBER	TYPE	# VIOLATIONS / # SAMPLES						TOTAL	PHOSPH	RESUL	CHLOROL	BACTERIA	#b	#c	#d	#e	#f	#g														
			TEMP	RESUL	D.O.	RESUL	pH	RESUL												RESUL	RESUL	RESUL	RESUL	RESUL	RESUL	RESUL				RESUL	RESUL	RESUL	RESUL
V-B39R	HKS2 0.96	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	PCB,Chlorodane,Heptachlor	
V-B40R	1BSSF038.27	A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NET			
V-B40R	SSF029.68	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NET			
V-B41R	1BSSF000.19	A	0 / 59	S	0 / 59	S	0 / 59	S	0 / 59	S	0 / 59	S	3 / 58	S			0	S	0	S					3	T	SI	NET	Multiple Organics				
V-B41R	1BSSF000.58	A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			/	NET	
V-B41R	1BSSF003.56	A	0 / 60	S	0 / 60	S	0 / 60	S	1 / 59	S			4 / 57	S			0	S	0	S					5	T	NI	REF					
V-B41R	SSF4 3.56	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NET			
V-B41R	SSF000.58	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S	0	S	0	S	0	NET			
V-B41R	SSF003.50	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S	0	S	0	S	0	NET			
V-B41R	SSF004.43	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S	0	S	0	S	0	NET			
V-B44R	NFS 94.51	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	PAH,INDENO[1,2,3-CD]PYREN	
V-B44R	NFS1a 102.2	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NET			
V-B45R	1BHMN002.09	A	0 / 36	S	0 / 36	S	0 / 36	S	1 / 34	S			20 / 34	N			0	S	0	S							SI	NET					
V-B45R	1BNFS081.42	A	0 / 59	S	0 / 59	S	1 / 59	S	1 / 59	S			10 / 59	P			0	S	0	S							NI	REF					
V-B45R	1BNFS093.53	A	0 / 59	S	0 / 59	S	1 / 59	S	0 / 58	S			5 / 58	S			0	S	0	S					2	T							
V-B45R	1BTRL000.02	A	0 / 21	S	0 / 21	S	0 / 21	S	0 / 19	S			2 / 19	T			0	S	0	S													
V-B45R	HMN 4 2.09	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET		
V-B45R	HMN2 7.59	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET		
V-B45R	HMN3 5.03	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET		
V-B45R	NFS4 81.61	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET		
V-B45R	TRL 0.02	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET		
V-B45R	NFS093.53	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S	0	S	0	S	0	NET			
V-B46R	1BLNV001.22	A	0 / 47	S	0 / 47	S	0 / 47	S	2 / 47	S			24 / 48	N			0	S	0	S	0	S	0	S	0	S	0	S	0	NET			
V-B46R	LNV 0.21	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET		
V-B47R	1BSMT004.60	A	0 / 59	S	0 / 59	S	0 / 59	S	2 / 59	S			14 / 59	P			0	S	0	S													
V-B47R	1BSMT023.18	A	0 / 21	S	0 / 21	S	0 / 21	S	1 / 19	S			7 / 19	P			0	S	0	S													
V-B47R	SMT 25.58	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	SS		
V-B47R	SMT 25.82	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	SS		
V-B47R	LAC	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	SS		
V-B47R	SMT 5.71	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	SS		
V-B47R	E.CAVE STP	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET		
V-B48R	1BMIL002.20	A	0 / 21	S	0 / 21	S	0 / 21	S	1 / 19	S			4 / 19	T			0	S	0	S	0	S	0	S	0	S	0	S	0	NET			
V-B48R	1BNFS070.67	A	0 / 59	S	0 / 59	S	0 / 59	S	1 / 59	S			8 / 59	S			0	S	0	S													
V-B48R	1BPCD000.20	A	0 / 2	J	0 / 2	J	0 / 2	J	0 / 3	J			2 / 3	T			0	S	0	S													
V-B48R	MIL 2.20	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	Station Moved to 1.03	
V-B49R	1BSTY001.22	A	0 / 60	S	0 / 60	S	0 / 60	S	29 / 59	T			7 / 58	S			0	S	0	S													
V-B49R	1BSTY005.85	A	0 / 60	S	0 / 60	S	0 / 60	S	1 / 59	S			6 / 57	S			0	S	0	S													
V-B49R	STY1 6.73	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	REF		
V-B49R	STY2 4.24	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	REF		
V-B50R	1BNFS029.69	A	0 / 36	S	0 / 36	S	0 / 36	S	1 / 36	S			0 / 34	S																			
V-B50R	1BNFS054.75	A	0 / 60	S	0 / 60	S	0 / 60	S	4 / 59	S			3 / 58	S			0	S	0	S													
V-B50R	1BNPC000.02	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 7	J			0 / 7	J			0	S	0	S													
V-B50R	1BPGH000.60	A	0 / 21	S	0 / 21	S	0 / 21	S	1 / 19	S			3 / 19	T			0	S	0	S													
V-B50R	1BTMB000.54	A	0 / 21	S	0 / 21	S	0 / 21	S	0 / 20	S			0 / 20	S			2	T	0	S													
V-B50R	NFS 54.75	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	Ar,Cu	
V-B50R	PGH 0.6	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET		
V-B50R	TMB 0.54	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET		
V-B51R	1BNFS000.57	A	0 / 60	S	0 / 60	S	0 / 60	S	1 / 60	S			6 / 59	S			0	S	0	S					3	T	SI	NET					
V-B51R	1BNFS010.34	A	0 / 60	S	0 / 60	S	0 / 60	S	0 / 59	S			4 / 57	S			0	S	0	S													
V-B51R	1BTBL000.26	A	0 / 21	S	0 / 21	S	0 / 20	S	0 / 20	S			0 / 19	S			0	S	0	S													
V-B51R	NFS 2.45	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	REF		
V-B51R	NSF000.57	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S	0	S	0	S	0	NET			
V-B51R	NSF000.58	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S					0	S	0	S	0	NET			
V-B52R	1BCDR023.47	A	6 / 21	P*	0 / 21	S	0 / 21	S	0 / 19	S			2 / 19	T			0	S	0	S													
V-B52R	BVR2 2.75	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET	Natural Conditions	
V-B53R	1BCDR013.29	A	0 / 60	S	0 / 60	S	0 / 60	S	0 / 59	S			2 / 57	S			0	S	0	S													
V-B53R	CDR13.29	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	NET		

Potomac - Shenandoah River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG & W I O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT				FISH TISSUE				BIO MON	TYPE BIOL STN	COMMENTS
	IDENTIFICATION NUMBER	TYPE	# VIOLATIONS / # SAMPLES						T O L	P H O R U S	E S U L T	C H L O P O L a	R E S U L T	C O L I F O R M	B A C T E R I A	# b	# c	# d	# e	# f	# g								
			T E M P	R E S U L T	D.O.	R E S U L T	pH	R E S U L T																					
V-B54R	1BPSG001.36	A	0 / 60	S	0 / 60	S	0 / 60	S	0 / 59	S	/	/	2 / 57	S					0 S	0 S					NI	REF	Antimony in sediment in '95		
V-B54R	PSG1 31.99	B	/	/	/	/	/	/	/	/	/	/	/	/										SI	NET				
V-B54R	PSG2 0.20	B	/	/	/	/	/	/	/	/	/	/	/	/															
V-B55R	1BSHN048.00	A	0 / 60	S	0 / 60	S	0 / 60	S	1 / 60	S	/	/	3 / 59	S					0 S	0 S					NI	SS			
V-B55R	MAN	B	/	/	/	/	/	/	/	/	/	/	/	/															
V-B55R	SHN1 47.98	B	/	/	/	/	/	/	/	/	/	/	/	/															
V-B55R	SHN052.03	C,SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S							
V-B55R	SHN053.63	SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S							
V-B56R	1BCRO000.43	A	0 / 28	S	0 / 28	S	0 / 28	S	0 / 27	S	/	/	4 / 27	S					0 S	0 S	0 S	0 S							
V-B56R	1BSTV004.08	A	0 / 17	S	0 / 17	S	0 / 17	S	11 / 15	T	/	/	2 / 16	T					0 S	0 S	0 S	0 S							
V-B57R	1BSPR000.40	A	2 / 21	S	0 / 21	S	0 / 21	S	0 / 19	S	/	/	5 / 19	P					0 S	0 S	0 S	0 S							
V-B57R	SPR 0.41	B	/	/	/	/	/	/	/	/	/	/	/	/											MI	REF			
V-B57R	SHN034.16	SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S							
V-B57R	SHN038.27	C,SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S							
V-B58R	1BSHN022.63	A	0 / 60	S	0 / 60	S	0 / 60	S	1 / 59	S	/	/	4 / 58	S					0 S	0 S	0 S	0 S							
V-B58R	SHN2 23.02	B	/	/	/	/	/	/	/	/	/	/	/	/											NI	NET			
V-B58R	SHN022.63	C,SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S							
V-B58R	SHN025.26	SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S							
N-A01R	1aPIA001.80	A	0 / 19	S	0 / 19	S	0 / 18	S	0 / 19	S	/	/	5 / 19	P					1 T										
N-A02R	1aNOC000.42	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 19	S	/	/	7 / 18	P															
N-A02R	1aCAX004.57	A,B	0 / 55	S	0 / 54	S	0 / 55	S	1 / 53	S	/	/	9 / 48	P											NI	REF			
N-A02R	1aS0C001.66	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 20	S	/	/	7 / 20	P															
N-A03R	1aLIM001.16	A	0 / 10	J	0 / 10	J	0 / 9	J	0 / 10	J	/	/	4 / 10	T															
N-A04R	1aGOO044.36	A,B	0 / 49	S	0 / 48	S	0 / 49	S	0 / 47	S	/	/	6 / 41	S											NI	NET			
N-A05R	1aCRM001.20	A	0 / 20	S	0 / 20	S	0 / 19	S	1 / 20	S	/	/	6 / 19	P					1 T										
N-A05R	1aGOO022.44	A	0 / 53	S	0 / 52	S	0 / 53	S	1 / 51	S	/	/	5 / 46	S															
N-A06R	1aNOG005.69	A	0 / 19	S	0 / 19	S	0 / 18	S	1 / 19	S	/	/	6 / 18	P															
N-A07R	1aBEC004.76	A	0 / 18	S	0 / 18	S	0 / 17	S	1 / 17	S	/	/	5 / 17	P															
N-A08R	1aGOO002.38	A,BC	0 / 55	S	0 / 54	S	0 / 55	S	3 / 53	S	/	/	6 / 49	S											MI	NET			
N-A08R	GOO0012.83	SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S							
N-A08R	1aTUS000.37	A	0 / 20	S	0 / 19	S	0 / 19	S	6 / 20	T	/	/	1 / 20	S					1 T										
N-A08R	1aSYC002.03	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 20	S	/	/	4 / 19	T															
N-A08R	1aLIV004.78	A,B	0 / 20	S	0 / 20	S	0 / 19	S	1 / 20	S	/	/	8 / 19	N											MI	NET			
N-A09R	1aHPR003.87	A	0 / 21	S	0 / 21	S	0 / 21	S	1 / 21	S	/	/	1 / 20	S															
N-A09R	1aBRB002.15	A	0 / 53	S	0 / 52	S	0 / 54	S	1 / 51	S	/	/	5 / 47	S															
N-A10R	1aSUG004.42	A	0 / 22	S	0 / 22	S	0 / 22	S	0 / 23	S	/	/	2 / 22	S															
N-A11R	1aDIF000.86	A,B	0 / 45	S	0 / 45	S	0 / 45	S	0 / 43	S	/	/	6 / 42	S											MI	NET			
N-A11R	1aDIF008.44	A	0 / 21	S	0 / 21	S	0 / 21	S	0 / 21	S	/	/	2 / 20	S															
N-A12E	1aFOU000.19	A	0 / 55	S	0 / 55	S	0 / 55	S	2 / 55	S	3 / 21	S	21 / 54	N															
N-A12R	1aPIM000.15	A	0 / 47	S	0 / 47	S	0 / 47	S	0 / 47	S	/	/	4 / 46	S															
N-A12R	1aPIM004.16	A	0 / 14	S	0 / 14	S	0 / 14	S	0 / 15	S	/	/	3 / 15	T															
N-A12R	1aFOU004.22	A	0 / 18	S	0 / 18	S	0 / 17	S	0 / 18	S	/	/	5 / 18	P															
N-A13E	1aHUT000.01	A,C,SS	0 / 56	S	0 / 56	S	0 / 56	S	2 / 56	S	4 / 19	T	10 / 55	P					0 S	0 S	0 S	0 S			3 T				
N-A13R	1aBAL001.40	A	0 / 20	S	0 / 20	S	0 / 19	S	0 / 20	S	/	/	3 / 19	T															
N-A13R	1aHOR001.30	A	0 / 20	S	0 / 20	S	0 / 19	S	0 / 20	S	/	/	2 / 19	T															
N-A14E	1aDOU000.60	A	0 / 50	S	0 / 50	S	1 / 49	S	2 / 53	S	19 / 25	T	0 / 50	S															
N-A14E	LIF000.01	C,SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S			0 S				
N-A14E	1aLIF000.19	A	0 / 66	S	0 / 65	S	1 / 66	S	2 / 55	S	27 / 31	T	3 / 55	S											2 T				
N-A15E	1aPOH002.32	A	0 / 68	S	3 / 68	S	5 / 66	S	3 / 63	S	28 / 37	T	2 / 59	S															
N-A15E	1aPOH000.21	A	0 / 11	J	0 / 11	J	0 / 11	J	0 / 12	J	5 / 8	T	0 / 12	J															
N-A15R	1aACO014.57	A	0 / 17	S	0 / 17	S	0 / 16	S	0 / 17	S	/	/	4 / 15	P															
N-A15R	1aACO006.10	A,B	0 / 53	S	0 / 53	S	0 / 52	S	1 / 52	S	/	/	4 / 50	S											MI	NET			
N-A16R	POH004.79	C,SS	/	/	/	/	/	/	/	/	/	/	/	/					0 S	0 S	0 S	0 S							
N-A16R	1aPOH007.65	A	0 / 20	S	0 / 19	S	0 / 19	S	0 / 19	S	/	/	1 / 17	S															
N-A16R	1aWLB000.06	A	0 / 4	J	0 / 4	J	0 / 4	J	1 / 3	J	/	/	1 / 3	J															
N-A17R	1aCER025.25	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 18	S	/	/	5 / 18	P															
N-A17R	1aLIL001.43	A	0 / 19	S	0 / 19	S	0 / 19	S	2 / 17	T	/	/	5 / 18	P															

Potomac - Shenandoah River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG & WBI O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA					OTHER MONITORING DATA										SEDIMENT				FISH TISSUE				BIO MON	TYPE BIOL STN	COMMENTS		
	IDENTIFICATION NUMBER	TYPE	# VIOLATIONS / # SAMPLES					T O L	P H	E S	C H L O a	R E S	C O L I T E R I A	R E S	M E X T C A E L E S D	R E S	# c O X R C G E A N D	R E S	# d M E X T C A E L E S D	# e R O X R C G E A N D	# f M E X T C A E L E S D	# g R O X R C G E A N D								
			T E M P	R E S	E S	E S	pH																							
N-A17R	CER016.74	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S	MI	NET	Silver in sediment in '95
N-A17R	1aCER016.46	A	0 / 20	S	0 / 20	S	0 / 20	S	2 / 18	T	/	/	5 / 18	P	/	/	/	/	/	/	/	/	/	/	/	/				
N-A18R	1aCER006.00	A	0 / 49	S	0 / 49	S	0 / 48	S	4 / 48	S	/	/	8 / 45	P	/	/	/	/	/	/	/	/	/	/	/	/				
N-A19R	1aSOT001.44	A,B	0 / 34	S	0 / 34	S	0 / 34	S	2 / 34	S	/	/	2 / 32	S	/	/	/	/	/	1	T	/	/	/	/	/				
N-A19R	1aKET000.80	A	0 / 14	S	1 / 14	S	0 / 14	S	1 / 13	S	/	/	4 / 12	T	/	/	/	/	/	/	/	/	/	/	/	/				
N-A19R	1aBRU020.12	A	0 / 31	S	0 / 31	S	0 / 31	S	0 / 31	S	/	/	5 / 29	S	/	/	/	/	/	1	T	/	/	/	/	/				
N-A19R	1aBRU007.58	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 17	S	/	/	3 / 17	T	/	/	/	/	/	/	/	/	/	/	/	/				
N-A20R	1aOCC024.74	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 18	S	/	/	2 / 16	T	/	/	/	/	/	/	/	/	/	/	/	/				
N-A21E	FOU000.45	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
N-A21R	BUL006.64	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S			
N-A21R	1aBUL025.94	A	0 / 21	S	0 / 21	S	0 / 21	S	0 / 20	S	/	/	0 / 19	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A21R	1aLII003.97	A	0 / 21	S	0 / 21	S	0 / 21	S	0 / 20	S	/	/	3 / 18	T	/	/	/	/	/	/	/	/	/	/	/	/				
N-A22R	1aCUB003.74	A	0 / 21	S	0 / 21	S	0 / 21	S	0 / 20	S	/	/	3 / 19	T	/	/	/	/	/	/	/	/	/	/	/	/				
N-A23R	1aBUL010.28	A,B	0 / 43	S	0 / 42	S	0 / 41	S	0 / 43	S	/	/	5 / 40	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A23R	1aPOE002.00	A,B	0 / 21	S	0 / 21	S	0 / 21	S	0 / 20	S	/	/	0 / 18	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A25E	OCC002.47	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S			
N-A25E	1aOCC006.71	A	0 / 17	S	0 / 17	S	0 / 17	S	0 / 16	S	/	/	0 / 14	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A25E	NEA00.51	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S			
N-A25E	1aNEA000.57	A	0 / 53	S	0 / 53	S	6 / 53	S	3 / 59	S	24 / 29	T	2 / 56	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A25E	1aOCC002.47	A	0 / 43	S	0 / 43	S	5 / 43	S	1 / 47	S	19 / 22	T	0 / 45	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A25R	1aNEA002.89	A	0 / 20	S	0 / 20	S	0 / 20	S	3 / 20	T	/	/	2 / 18	T	/	/	/	/	/	/	/	/	/	/	/	/				
N-A26E	1aCHO003.65	A	0 / 51	S	0 / 51	S	0 / 51	S	1 / 52	S	/	/	2 / 51	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A26R	1aQUA004.46	A,C,SS	0 / 53	S	0 / 53	S	0 / 53	S	1 / 53	S	/	/	3 / 52	S	/	/	/	/	/	2	T	/	/	/	/	3	T			
N-A26R	1aPOW003.11	A,C,SS	0 / 18	S	0 / 17	S	1 / 17	S	0 / 17	S	/	/	0 / 15	S	/	/	/	/	/	0	S	0	S	0	S	3	T			
N-A27R	1aUA014.51	A	0 / 17	S	0 / 16	S	2 / 16	T	0 / 16	S	/	/	1 / 15	S	/	/	/	/	/	0	S	0	S	0	S	0	S			
N-A27R	1aBED002.97	A	0 / 19	S	0 / 18	S	1 / 18	S	0 / 18	S	/	/	0 / 16	S	/	/	/	/	/	1	T	/	/	/	/	/				
N-A28E	1aUA003.71	A	0 / 42	S	0 / 42	S	1 / 42	S	0 / 44	S	18 / 22	T	0 / 39	S	/	/	/	/	/	1	T	/	/	/	/	/				
N-A29E	1aPOM002.41	A	0 / 43	S	0 / 43	S	3 / 43	S	0 / 45	S	16 / 22	T	0 / 41	S	/	/	/	/	/	1	T	/	/	/	/	/				
N-A29L	1aPOM013.02	A	0 / 1	J	0 / 1	J	0 / 1	J	0 / 1	J	/	/	0 / 1	J	/	/	/	/	/	0	S	0	S	0	S	0	S			
N-A29L	LOH 002.20	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S			
N-A29L	1aLOM007.93	A	0 / 1	J	0 / 1	J	1 / 1	J	0 / 1	J	/	/	0 / 1	J	/	/	/	/	/	1	T	/	/	/	/	/				
N-A29R	1aACCO06.13	A	0 / 19	S	0 / 18	S	1 / 18	S	0 / 19	S	/	/	1 / 17	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A29R	1aPOM006.72	A	0 / 19	S	2 / 18	T	1 / 18	S	1 / 18	S	/	/	0 / 17	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A30E	1aWLL001.30	A	0 / 35	S	5 / 35	S	0 / 35	S	9 / 35	T	3 / 4	T	2 / 33	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A30E	1aUMC004.43	A	0 / 35	S	1 / 35	S	1 / 35	S	2 / 34	S	3 / 4	T	1 / 33	S	/	/	/	/	/	/	/	/	/	/	/	/				
N-A30R	1aUMC009.61	A	0 / 20	S	0 / 20	S	0 / 20	S	3 / 19	T	/	/	1 / 20	S	/	/	/	/	/	1	T	/	/	/	/	/				
N-A30R	1aWLL002.21	A	0 / 20	S	1 / 20	S	0 / 20	S	7 / 19	T	4 / 4	T	4 / 20	T	/	/	/	/	/	/	/	/	/	/	/	/				
P-A31E	1AMON000.96	A	0 / 58	S	0 / 58	S	2 / 58	S	3 / 56	W*	3 / 3	J	3 / 56	S	/	/	/	/	0	/	0	/	0	/	0	/				
P-A31E	1AMAO004.08	A	0 / 34	S	0 / 34	S	1 / 34	S	1 / 32	S	/	/	7 / 31	P	/	/	/	/	1	/	0	/	0	/	0	/				
P-A31R	1AMAO007.46	A	0 / 7	J	0 / 7	J	7 / 7	T*	0 / 5	J	/	/	1 / 6	J	/	/	/	/	0	/	0	/	0	/	0	/				
P-A31R	1APIN000.57	A	0 / 21	S	2 / 21	S	3 / 21	S	0 / 19	S	/	/	0 / 20	S	/	/	/	/	0	/	0	/	0	/	0	/				
P-A32E	1ANOM004.84	A	0 / 30	S	0 / 30	S	0 / 30	S	0 / 29	W*	0 / 0	/	3 / 47	S	/	/	/	/	0	/	0	/	0	/	0	/				
P-A32E	1ANOM005.99	A	0 / 28	S	0 / 28	S	0 / 28	S	0 / 27	W*	0 / 0	/	0 / 28	S	/	/	/	/	/	/	/	/	/	/	/	/				
P-A32R	1ANOM011.37	A	0 / 6	J	0 / 6	J	0 / 6	J	0 / 5	J	/	/	1 / 6	J	/	/	/	/	/	/	/	/	/	/	/	/				
P-A33E	1ALOG001.20	A	0 / 22	S	2 / 22	S	0 / 22	S	0 / 22	W*	0 / 1	J	3 / 40	S	/	/	/	/	0	/	0	/	0	/	0	/				
P-A33R	1AMIA004.12	A	0 / 6	J	0 / 6	J	0 / 6	J	0 / 5	J	/	/	1 / 5	J	/	/	/	/	0	/	0	/	0	/	0	/				
P-A34E	1ACOA001.44	A	0 / 19	S	0 / 18	S	0 / 19	S	0 / 20	W*	0 / 1	J	1 / 20	S	/	/	/	/	0	/	0	/	0	/	0	/				
P-A34E	1ALIS002.00	A	0 / 18	S	0 / 17	S	0 / 18	S	0 / 18	W*	0 / 2	J	1 / 19	S	/	/	/	/	0	/	0	/	0	/	0	/				
P-A34R	1ACON000.96	A	0 / 6	J	0 / 6	J	0 / 6	J	0 / 6	J	/	/	0 / 5	J	/	/	/	/	0	/	0	/	0	/	0	/				

James River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG & WIND	MONITORING STATIONS	CONVENTIONAL WATER COLUMN MONITORING DATA										OTHER MONITORING DATA										SEDIMENT.		FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS
		TEMP	# VIOLATIONS / # SAMPLES		RESUL	D.O.	pH	TOL	PHOS	RESUL	CHLOR	RESUL	COLIFORM	BACTERIA	#b	#c	#d	#e	#f	#g										
IDENTIFICATION NUMBER	TYPE	TEMP	RESUL	D.O.	pH	TOL	PHOS	RESUL	CHLOR	RESUL	COLIFORM	BACTERIA	#b	#c	#d	#e	#f	#g												
V-I01R	JKS1 67	B	/		/		/		/		/												SI	REF	Natural Conditions					
V-I01R	2-JKS058.60	A	10 / 59	T*	0 / 59	S	0 / 59	S	0 / 55	S	/		2 / 52	S			0	S	0	S			SI	REF						
V-I02R	LTB 7.76	B	/		/		/		/		/												SI	NET						
V-I02R	BCC1 20.81	B	/		/		/		/		/														Natural Conditions					
V-I02R	2-BCC004.71	A	0 / 58	S	0 / 58	S	0 / 58	S	0 / 56	S	/		0 / 52	S			0	S	0	S										
V-I04R	2-CRE002.37	A	12 / 59	P*	0 / 59	S	0 / 59	S	0 / 54	S	/		1 / 50	S			0	S	0	S										
V-I12R	2-CWP068.52	A	0 / 20	S	0 / 20	S	0 / 20	S	1 / 17	S	/		1 / 17	S			0	S	0	S					Ni					
V-I13R	BLP 0.79	B	/		/		/		/		/												NI	REF						
V-I13R	2-BLP000.79	A	4 / 57	S	0 / 57	S	1 / 57	S	0 / 55	S	/		2 / 51	S			1	T	0	S			VI	SS						
V-I14R	CYB 0.36	B	/		/		/		/		/												NI	REF	Ni					
V-I14R	CWP1a 50.66	B	/		/		/		/		/												NI	NET						
V-I14R	CST 7.42	B	/		/		/		/		/												NI	NET						
V-I14R	CFP 3.94	B	/		/		/		/		/														Ni					
V-I14R	2-CWP050.66	A	0 / 3	J	0 / 3	J	0 / 3	J	0 / 2	J	/		0 / 1	J			1	T	0	S										
V-I15R	2-STU005.00	A	0 / 3	J	0 / 3	J	0 / 3	J	0 / 2	J	/		0 / 1	J			0	S	0	S										
V-I16R	CWP1 42.06	B	/		/		/		/		/												NI	REF	Pb & Natural Conditions					
V-I28R	2-ELK001.37	A	3 / 10	T*	0 / 10	J	0 / 10	J	0 / 9	J	/		0 / 7	J			1	T	0	S										
V-I28R	2-CEC000.04	A	0 / 10	J	0 / 10	J	0 / 10	J	0 / 8	J	/		0 / 6	J			0	S	0	S										
V-I28R	JMS295.68	SS	/		/		/		/		/														Natural Conditions					
V-I29R	2-CFP036.20	A	0 / 3	J	0 / 3	J	0 / 3	J	0 / 2	J	/		0 / 2	J			0	S	0	S										
V-I30R	CDR1a 43.01	B	/		/		/		/		/												NI	REF						
V-I30R	CDR1 13.29	B	/		/		/		/		/												SI	NET	Natural Conditions					
V-I30R	2-CFP004.67	A	0 / 59	S	0 / 59	S	0 / 59	S	0 / 55	S	/		0 / 50	S																
V-I31R	BRT 0.94	B	/		/		/		/		/												SI	NET						
V-I31R	2-BRT000.94	A	6 / 18	P*	0 / 18	S	1 / 18	S	1 / 16	S	/		2 / 16	T			0	S	0	S					Natural Conditions					
V-I32R	LCF2 0.76	B	/		/		/		/		/												VI	NET						
V-I32R	LCF1 4.80	B	/		/		/		/		/												SI	NET						
V-I32R	CKS 3.04	B	/		/		/		/		/												VI	NET	Natural Conditions					
V-I32R	2-LCF007.00	A	0 / 58	S	0 / 58	S	0 / 58	S	0 / 55	S	/		2 / 51	S			0	S	0	S										
V-I33R	KRR 1.54	B	/		/		/		/		/												MI	NET						
V-I33R	2-KRR001.54	A	0 / 9	J	0 / 9	J	0 / 9	J	0 / 8	J	/		0 / 7	J			0	S	0	S					Natural Conditions					
V-I33R	MRY029.17	SS	/		/		/		/		/																			
V-I34R	2-HYS001.41	A	5 / 22	P*	0 / 22	S	0 / 22	S	2 / 21	S	/		5 / 20	P			0	S	0	S										
V-I35R	WST 2.60	B	/		/		/		/		/												NI	REF	PCB					
V-I35R	2-MRY038.10	A	0 / 59	S	0 / 59	S	0 / 58	S	0 / 58	S	/		3 / 58	S			0	S	0	S										
V-I35R	2-MIS000.04	A	0 / 22	S	0 / 22	S	0 / 22	S	0 / 20	S	/		5 / 20	P																
V-I35R	2-CGB001.80	A	0 / 18	S	0 / 18	S	0 / 18	S	0 / 17	S	/		4 / 16	P			0	S	0	S					PCB					
V-I35R	MRY023.81	SS	/		/		/		/		/																			
V-I36R	STM 1.52	B	/		/		/		/		/												SI	NET						
V-I36R	STH 0.21	B	/		/		/		/		/												NI	REF						
V-I37R	MRY 5.58	B	/		/		/		/		/												SI	NET	PCB					
V-I37R	2-MRY014.78	A	0 / 59	S	0 / 59	S	0 / 58	S	0 / 58	S	/		3 / 58	S			0	S	0	S										
V-I37R	2-MRY013.00	A	/		/		/		/		/																			
V-I37R	2-MRY005.39	A	0 / 59	S	0 / 59	S	1 / 58	S	0 / 58	S	/		2 / 58	S			0	S	0	S					PCB					
V-I37R	2-MRY000.46	A	0 / 59	S	0 / 59	S	1 / 58	S	11 / 59	T	/		5 / 59	S			0	S	0	S										
V-I37R	MRY004.88	SS	/		/		/		/		/																			
V-I37R	MYR013.00	C,SS	/		/		/		/		/												0	S	NET					
V-I38R	2-BLD001.00	A	0 / 59	S	0 / 59	S	0 / 58	S	0 / 57	S	/		1 / 58	S			0	S	0	S										
V-I38R	BLD 0.22	SS	/		/		/		/		/																			
W-I04R	2-JKS024.14	SS	/		/		/		/		/						0		0					SI	NET	Inten. Survey				

James River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG & W I O B O I N D	MONITORING STATIONS	CONVENTIONAL WATER COLUMN MONITORING DATA										OTHER MONITORING DATA										SEDIMENT.		FISH TISSUE.		BIO MON	TYPE BIOL STN	COMMENTS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
		# VIOLATIONS / # SAMPLES										C O L T	B A C T E R I A	# b	# c	# d	# e	# f	# g																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		R E S U L T	D.O.	R E S U L T	pH	R E S U L T	T O T A L	P H O R U S	R E S U L T	C H L O R O L a	R E S U L T									I F O R M	R E S U L T	M E T A L S	R E S U L T	O X I D A T I O N	R E S U L T				M E T A L S	R E S U L T	O X I D A T I O N	R E S U L T	M E T A L S	R E S U L T	O X I D A T I O N																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
W-I04R	2-JKS026.01	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

James River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG & W I O I N D	MONITORING STATIONS	CONVENTIONAL WATER COLUMN MONITORING DATA										OTHER MONITORING DATA										SEDIMENT.		FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS
		T Y P E	T E M P	# VIOLATIONS / # SAMPLES		R E S U L T	D.O.	R E S U L T	pH	R E S U L T	T O L A N C E	P H O R O S P H O R Y	R E S U L T	C H L O R O L A	R E S U L T	O L I M	B A C T E R I A L	# b	# c	# d	# e	# f	# g							
	IDENTIFICATION NUMBER																													
W-H02R	2-POL000.04	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 0	W	/																	Sb, Cd & Zn exceed in sed.		
W-H03R	2-JMS258.54	A	0 / 60	S	0 / 60	S	0 / 60	S	7 / 58	S	/																	Above Griffin Pipe & Lynchburg STP		
W-H03R	2-IVA000.22	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																	Lynchburg CSOs		
W-H03R	2-FSG000.85	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																			
W-H03R	2-BKW000.40	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																			
W-H03R	JMS261.02	SS	/		/		/		/		/																			
W-H03R	JMS258.54	C,SS	/		/		/		/		/																			
W-H03R	JMS255.22	SS	/		/		/		/		/																			
W-H04R	2-HAZ000.04	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																	Sb in sed.		
W-H05R	2-OPP000.16	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 0	W	/																			
W-H05R	JMS229.14	C,SS	/		/		/		/		/																	Level 1 PCB/Chlordane/DDT		
W-H05R	JMS231.24	SS	/		/		/		/		/																			
W-H05R	2-BCR000.20	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																			
W-H06R	2-WIC000.40	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																			
W-H07R	2-BTC000.16	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																			
W-H08R	2-JMS231.24	SS	0 / 0		0 / 0		0 / 0		0 / 0		/																	DDT in sed.		
W-H08R	2-JMS229.14	A	0 / 60	S	0 / 60	S	0 / 60	S	12 / 58	T	/																	Fsh. Tiss. PCB, DDT, Chlorodane		
W-H08R	2-JMS228.03	B	0 / 0		0 / 0		0 / 0		0 / 0		/																	Last RBP II 1992 - Res. Judgement		
W-H10R	2-LIR000.01	A	0 / 4	S	0 / 4	S	0 / 4	S	0 / 0	W	/																	Station discontinued 5/93		
W-H12R	2-RTD003.30	A,B	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																	Abv. Amherst S. Last RBPII Fall 93		
W-H12R	2-RTD003.08	A,B	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																	Blw Amherst S. Last RBPII Fall 93		
W-H12R	2-BUF012.85	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	/																			
V-H08R	JMS229.14	C,SS	/		/		/		/		/																			
V-H09R	TYE2 20.67	B	/		/		/		/		/																	SI		
V-H09R	TYE1 32.71	B	/		/		/		/		/																	NI		
V-H09R	MSB 0.01	B	/		/		/		/		/																	VI		
V-H09R	MIO 0.35	B	/		/		/		/		/																	SS		
V-H09R	MIO 0.19	B	/		/		/		/		/																	NI		
V-H10R	PNY 5.3	B	/		/		/		/		/																	SI		
V-H10R	2-PNY005.29	A	0 / 60	S	0 / 60	S	1 / 60	S	1 / 56	S	/																	REF		
V-H10R	2-PNY003.06	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 0	J	/																	REF		
V-H12R	2-BUF002.10	A	0 / 60	S	0 / 60	S	0 / 60	S	4 / 56	S	/																			
V-H12R	BUF 2.18	B	/		/		/		/		/																	MI		
V-H13R	2-TYE000.30	A	0 / 60	S	0 / 60	S	0 / 60	S	2 / 55	S	/																	NET		
V-H13R	2-RKR000.02	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 6	J	/																			
V-H13R	TYE007.59	SS	/		/		/		/		/																			
V-H14R	JMS210.51	SS	/		/		/		/		/																			
V-H14R	2-SCM000.23	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 11	J	0 / 0																			
V-H15R	2-RFS001.00	A	0 / 21	S	0 / 21	S	1 / 21	S	1 / 20	S	/																			
V-H16R	RKF 23.33	B	/		/		/		/		/																	MI		
V-H16R	2-RKF000.19	A	0 / 60	S	0 / 60	S	0 / 60	S	2 / 53	S	/																	NET		
V-H17R	2-RKI003.40	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 19	S	0 / 0																			
V-H17R	2-TOT002.61	A	0 / 36	S	0 / 36	S	0 / 36	S	1 / 33	S	/																			
V-H17R	2-JMS189.31	A	0 / 60	S	0 / 60	S	0 / 60	S	4 / 53	S	/																			
V-H17R	2-BLR003.00	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 6	J	/																			
V-H17R	JMS184.22	SS	/		/		/		/		/																			
V-H18R	2-HNF008.28	A	0 / 2	J	0 / 2	J	0 / 2	J	0 / 2	J	/																			
V-H19R	2-HRD011.57	A	0 / 59	S	0 / 59	S	2 / 59	S	4 / 53	S	/																			
V-H19R	HRD001.00	C,SS	/		/		/		/		/																			
V-H19R	2-LTD000.96	A	0 / 11	J	0 / 11	J	0 / 11	J	0 / 11	J	0 / 0																			
V-H20R	JMS176.48	SS	/		/		/		/		/																			
V-H20R	JMS176.63	C	/		/		/		/		/																			
V-H23R	2-MCM018.92	A	0 / 3	J	0 / 3	J	0 / 3	J	0 / 3	J	/																			
V-H23R	2-MCM005.12	A	0 / 60	S	0 / 60	S	1 / 60	S	0 / 59	S	/																			
V-H23R	2-LKN003.70	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 19	S	/																			
V-H23R	2-BVR005.70	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 3	J	/																			

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		# VIOLATIONS / # SAMPLES										C O L I T	B A C T E R I A	# b	# c	# d	# e	# f	# g																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
		R E S U L T	D.O.	R E S U L T	pH	R E S U L T	T O T A L	P H O R U S	R E S U L T	C H L O P H Y L L a	R E S U L T											M E T A	R E S U L T	M E T A	R E S U L T	M E T A	R E S U L T	M E T A	R E S U L T				M E T A	R E S U L T	M E T A	R E S U L T	M E T A	R E S U L T	M E T A	R E S U L T	M E T A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
V-H24R	2-MNR000.39	A	0 / 10	J	0 / 10	J	0 / 10	J	0 / 8	J	/			0 / 8	J	/																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									

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		# VIOLATIONS / # SAMPLES										C O L I C T R I A										# b	# c	# d	# e	# f	# g																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		R E S U L T	R E S U L T	R E S U L T	T O T A L	P H O R O S P S	R E S U L T	C H L O P H Y L O L a	R E S U L T	C O L I F O R M	R E S U L T	B A C T E R I A	R E S U L T	M E T A L S	R E S U L T	E X T R A C T	R E S U L T	E X T R A C T	R E S U L T	E X T R A C T	R E S U L T	E X T R A C T	R E S U L T	E X T R A C T																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		D.O.	pH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
P-G01E	JMS100.16	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

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		TYPE	TEMP	# VIOLATIONS / # SAMPLES		RESULT	D.O.	T	pH	SOL	TOTAL	PHOS	SIL	CHL	PHYL	RES	COL	BACT	#b	#c	RES	ME	RES	E	RES	ME	RES	E	RES				ME	RES	E	RES	#f	#g
				U	U																																	
				U	U																																	
IDENTIFICATION NUMBER	TYPE	TEMP	U	D.O.	T	pH	SOL	TOTAL	PHOS	SIL	CHL	PHYL	RES	COL	BACT	RES	ME	RES	E	RES	ME	RES	E	RES	ME	RES	E	RES	ME	RES	E	RES	#f	#g				
P-H39R	2-JMS117.35	A	0 / 59	S	0 / 59	S	0 / 59	S	5 / 58	S	/	/	/	/	/	/	4 / 57	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		
P-H39R	2-PWT000.57	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 8	J	/	/	/	/	/	/	1 / 8	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-H39R	2-RDD000.19	A	0 / 11	J	0 / 11	J	0 / 11	J	0 / 11	J	/	/	/	/	/	/	4 / 11	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-H39R	2-TKO004.69	A	0 / 23	S	12 / 23	N	1 / 23	S	0 / 19	S	/	/	/	/	/	/	5 / 19	P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-H39R	JMS129.14	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-H39R	JMS115.75	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-H39R	JMS113.39	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J01R	2-APP118.04	A	0 / 44	S	0 / 44	S	0 / 44	S	3 / 44	S	/	/	/	/	/	/	12 / 44	P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J01R	APP105.76	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J02R	2-BFL002.00	A	0 / 20	S	0 / 20	S	1 / 20	S	0 / 20	S	/	/	/	/	/	/	4 / 20	T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J02R	2-SPA001.46	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	/	/	2 / 12	T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J03R	2-SDY003.00	A	0 / 20	S	1 / 20	S	0 / 20	S	0 / 20	S	/	/	/	/	/	/	2 / 20	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J04R	2-BSR002.82	A	0 / 12	J	0 / 12	J	0 / 12	J	1 / 12	J	/	/	/	/	/	/	2 / 12	T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J05R	2-BRI001.00	A	0 / 12	J	0 / 12	J	0 / 12	J	1 / 12	J	/	/	/	/	/	/	2 / 12	T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J06R	2-APP090.12	A	0 / 60	S	0 / 60	S	0 / 60	S	2 / 60	S	/	/	/	/	/	/	12 / 60	P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J06R	2-BGU001.39	A	0 / 20	S	1 / 20	S	1 / 20	S	0 / 20	S	/	/	/	/	/	/	3 / 20	T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J06R	2-SYL001.26	A	0 / 20	S	0 / 20	S	0 / 20	S	2 / 20	S	/	/	/	/	/	/	9 / 20	N	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J06R	APP091.04	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J07R	2-SQT001.54	A	0 / 13	S	5 / 13	Z	6 / 13	Z	0 / 12	J	/	/	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J07R	APP058.29	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J07R	APP060.91	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J07R	APP081.80	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J08R	2-FLA001.95	A	0 / 20	S	0 / 20	S	0 / 20	S	2 / 20	S	/	/	/	/	/	/	6 / 20	P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J09R	2-NBB003.65	A	0 / 12	J	0 / 12	J	0 / 12	J	1 / 12	J	/	/	/	/	/	/	2 / 12	T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J10R	2-APP050.23	A	0 / 58	S	0 / 58	S	1 / 58	S	2 / 58	S	/	/	/	/	/	/	14 / 58	P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J10R	APP052.39	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J11R	2-DPC005.20	A	0 / 22	S	0 / 22	S	0 / 22	S	1 / 20	S	/	/	/	/	/	/	3 / 20	T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J11R	2-DPC019.03	A	0 / 14	S	7 / 14	Z	0 / 14	S	0 / 12	J	/	/	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J11R	2-XGP001.80	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J11R	2-XGP002.20	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J12R	2-WPK003.23	A	0 / 24	S	8 / 24	P	11 / 24	N	0 / 20	S	/	/	/	/	/	/	1 / 20	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J12R	2-WTK001.50	A	0 / 14	S	7 / 14	N	9 / 14	N	0 / 12	J	/	/	/	/	/	/	1 / 9	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J13R	2-NMZ011.69	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J14R	2-WNK003.38	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J15E	2-APP001.53	A	0 / 71	S	0 / 71	S	0 / 70	S	0 / 25	S	24 / 81	T	12 / 58	P	12 / 58	P	12 / 58	P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J15E	APP001.53	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J15E	APP004.12	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J15E	APP005.19	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J15R	2-APP012.79	A	0 / 60	S	0 / 60	S	0 / 60	S	0 / 57	S	/	/	/	/	/	/	6 / 58	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J15R	2-APP013.00	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J15R	2-APP016.38	A	0 / 173	S	0 / 173	S	0 / 174	S	0 / 92	S	/	/	/	/	/	/	0 / 0	W	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J15R	2-OTC002.49	A	0 / 8	J	0 / 8	J	1 / 8	J	0 / 7	J	/	/	/	/	/	/	1 / 7	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J15R	APP015.38	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-J16R	2-SFT035.26	A	0 / 20	S	3 / 20	Z	6 / 20	Z	0 / 20	S	/	/	/	/	/	/	2 / 19	T	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J17R	2-SFT004.92	A	0 / 20	S	0 / 20	S	1 / 20	S	0 / 19	S	/	/	/	/	/	/	1 / 19	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-J17R	2-SFT019.15	A	0 / 13	S	3 / 13	T	1 / 13	S	0 / 12	J	/	/	/	/	/	/	1 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-G01E	2-JMS110.31	SS	0 / 37	S	0 / 37	S	0 / 37	S	1 / 11	W*	0 / 0	0	0	0	0	0	19 / 35	N	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/				
P-G01E	2-JMS110.30	A	1 / 119	S	0 / 119	S	2 / 119	S	0 / 38	W*	0 / 0	110	0	0	0	0	26 / 96	P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-G01E	2-JMS110.07	SS	0 / 38	S	0 / 38	S	0 / 38	S	2 / 12	W*	0 / 0	0	0	0	0	0	29 / 37	N	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
P-G01E	2-JMS109.39	SS	0 / 32	S	0 / 32	S	0 / 32	S	0 / 11	W*	0 / 0	0	0	0	0	0	11 / 33	P	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/					

James River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REG & W I B O I N D	MONITORING STATIONS	CONVENTIONAL WATER COLUMN MONITORING DATA										OTHER MONITORING DATA										SEDIMENT.		FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS
		IDENTIFICATION NUMBER	TYPE	TEMP	# VIOLATIONS / # SAMPLES		D.O.	pH	TOL	PHORSU	RESUL	CHLOROLa	RESUL	COLIFORM	BACTERIAL	#b	#c	RESUL	METALS	RESUL	#d	#e	#f	#g						
					RESUL	RESUL																								
					RESUL	RESUL																								
T-G10E	2-JMS032.59	A	0 / 63	S	0 / 63	S	0 / 62	S	/	/	/	/	1 / 40	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	2-JMS042.52	A	0 / 10	J	0 / 10	J	0 / 10	J	/	/	/	/	0 / 1	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	2-JMS042.92	A	0 / 63	S	0 / 63	S	0 / 62	S	/	/	/	/	2 / 40	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	2-JMS042.96	A	0 / 10	J	0 / 10	J	0 / 9	J	/	/	/	/	1 / 1	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	2-MIC000.03	A	0 / 57	S	0 / 57	S	1 / 57	S	/	/	/	/	7 / 58	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	2-MIC002.44	A	0 / 1	J	0 / 1	J	0 / 1	J	/	/	/	/	0 / 0	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	2-POW000.60	A	0 / 53	S	0 / 53	S	0 / 53	S	/	/	/	/	9 / 55	P	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	RET5.2	A	/	/	/	/	/	/	/	/	2 / 66	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	RET5.2N	A	/	/	/	/	/	/	/	/	0 / 5	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10E	RET5.2S	A	/	/	/	/	/	/	/	/	0 / 5	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G10R	2-CGE001.41	A	0 / 22	S	13 / 22	Z	0 / 22	S	/	/	/	/	1 / 19	S	/	/	/	/	/	/	/	/	/	/	/	/	/	Natural Conditions		
T-G10R	2-POW006.77	A/B	0 / 21	S	1 / 21	S	0 / 21	S	0 / 21	S	/	/	1 / 20	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-CKT000.19	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	0 / 12	J	/	/	/	/	/	/	1	T	/	/	/	/	/	NI		
T-G11E	2-CKT000.84	A	0 / 49	S	0 / 49	S	0 / 49	S	/	/	/	/	1 / 49	S	/	/	/	/	/	/	5	T	/	/	/	/	/	Lead 96 Pb 93; Sb, Ni 95; Zn 93,95		
T-G11E	2-CKT002.22	A	0 / 12	J	1 / 12	J	0 / 12	J	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-DEP000.26	A	0 / 22	S	0 / 22	S	0 / 22	S	/	/	/	/	4 / 22	S	/	/	/	/	/	/	3	T	/	/	/	/	/	Lead 96; Zinc 96,97		
T-G11E	2-JMS013.10	A	0 / 63	S	0 / 63	S	0 / 61	S	/	/	/	/	0 / 51	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-JMS017.01	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	PCB in fish tissue 94, 96		
T-G11E	2-JMS021.04	A	0 / 63	S	1 / 63	S	0 / 62	S	/	/	/	/	0 / 39	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-JMS021.34	A	0 / 10	J	0 / 10	J	0 / 10	J	/	/	/	/	0 / 1	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-JMS021.74	A	0 / 10	J	0 / 10	J	0 / 10	J	/	/	/	/	0 / 1	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-JOG000.62	A	0 / 30	S	0 / 30	S	0 / 30	S	/	/	/	/	0 / 29	S	/	/	/	/	/	/	1	T	/	/	/	/	/	Antimony 1995		
T-G11E	2-PGN000.00	A	0 / 26	S	0 / 26	S	1 / 26	S	/	/	/	/	1 / 25	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-PGN000.80	A	0 / 30	S	0 / 30	S	0 / 30	S	/	/	/	/	1 / 29	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-PGN001.19	A	0 / 30	S	0 / 30	S	1 / 30	S	/	/	/	/	1 / 29	S	/	/	/	/	/	/	1	T	/	/	/	/	/	Antimony 1995		
T-G11E	2-PGN002.58	A	0 / 29	S	0 / 29	S	1 / 29	S	/	/	/	/	2 / 28	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-PGN003.57	A	0 / 28	S	1 / 28	S	1 / 28	S	/	/	/	/	5 / 27	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-PGN004.57	A	0 / 29	S	1 / 29	S	1 / 29	S	/	/	/	/	3 / 26	S	/	/	/	/	/	/	1	T	/	/	/	/	/	Antimony 1995		
T-G11E	2-PGN005.46	A	0 / 29	S	2 / 29	S	0 / 29	S	/	/	/	/	9 / 27	P	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-PGN006.65	A	0 / 29	S	3 / 29	S	0 / 29	S	/	/	/	/	8 / 27	P	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-PGN007.44	A	1 / 28	S	2 / 28	S	0 / 28	S	/	/	/	/	9 / 27	P	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-PGN008.42	A	0 / 28	S	2 / 28	S	0 / 28	S	/	/	/	/	9 / 27	P	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	2-WWK003.98	A	0 / 22	S	0 / 22	S	0 / 22	S	/	/	/	/	4 / 22	S	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	LE5.1	A	/	/	/	/	/	/	/	/	0 / 66	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	LE5.2	A	/	/	/	/	/	/	/	/	1 / 65	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	LE5.2N	A	/	/	/	/	/	/	/	/	0 / 5	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	LE5.2S	A	/	/	/	/	/	/	/	/	0 / 5	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11E	LE5.3	A	/	/	/	/	/	/	/	/	1 / 67	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G11R	2-BAP000.80	B	0 / 4	J	0 / 4	J	0 / 4	J	0 / 4	J	/	/	1 / 4	J	/	/	/	/	/	/	/	/	/	/	/	/	/	NI		
T-G11R	2-CKT005.72	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI		
T-G11R	2-CRL004.04	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI		
T-G11R	2-PGN010.07	A	0 / 59	S	4 / 59	S	0 / 59	S	2 / 59	S	/	/	4 / 59	S	/	/	/	/	/	/	1	T	/	/	/	/	/	Antimony 1996		
T-G12R	2-CHN006.40	B	0 / 1	J	0 / 1	J	1 / 1	J	0 / 1	J	/	/	0 / 1	J	/	/	/	/	/	/	/	/	/	/	/	/	/	NI		
T-G12R	2-ELE001.60	B	0 / 2	J	0 / 2	J	0 / 2	J	1 / 2	J	/	/	0 / 2	J	/	/	/	/	/	/	/	/	/	/	/	/	/	NI		
T-G12R	2-ELE003.40	A/B	0 / 13	S	0 / 13	S	7 / 13	Z	0 / 13	S	/	/	0 / 13	S	/	/	/	/	/	/	/	/	/	/	/	/	/	NI		
T-G13E	2-NAN000.20	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G13E	2-NAN002.77	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G13E	2-NAN005.82	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G13E	2-NAN007.89	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	0 / 12	J	/	/	/	/	/	/	/	/	/	/	/	/	/			
T-G13E	2-NAN010.69	A	0 / 12	J	1 / 12	J	0 / 12	J	/	/	/	/	1 / 11	J	/	/	/	/	/	/	/	/	/	/	/	/	/			

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REG & W I B O I N D	MONITORING STATIONS	CONVENTIONAL WATER COLUMN MONITORING DATA										OTHER MONITORING DATA										SEDIMENT.		FISH TISSUE.		BIO MON	TYPE BIOL STN	COMMENTS																																
		T Y P E	T E M P	# VIOLATIONS / # SAMPLES		R E S U L T	D.O.	T	pH	T	L	T	P H O R O S P S	R	C H L O R Y O L a	R	C L I F E R I M A	# b	# c	R	M E T R I C S D	R	E X T R A C T S D	# d	# e				R	M E T R I C S D	# f	# g																												
				S	U																																																							
IDENTIFICATION NUMBER																																																												
T-G13E	2-NAN013.50	A	0 / 6	J	1 / 6	J	0 / 6	J	/	/	/	/	1 / 6	J	/	/	/	/	/	/	/	/	/	1	T	/	/	/	/	/	/	Lead 93																												
T-G13E	2-NAN019.14	A	1 / 59	S	2 / 59	S	1 / 59	S	/	/	/	/	34 / 59	N	/	/	/	/	/	/	/	/	1	T	/	/	/	/	/	/	/																													
T-G13E	2-SGL001.00	A	1 / 59	S	5 / 59	S	5 / 59	S	/	/	/	/	23 / 59	N	/	/	/	/	/	/	/	/	2	T	/	/	/	/	/	/	/	Antimony 95 and 96																												
T-G13R	2-BEN001.42	A	0 / 59	S	3 / 59	S	3 / 59	S	6 / 59	S	/	/	3 / 59	S	/	/	/	/	/	/	/	/	2	T	/	/	/	/	/	/	/																													
T-G15E	2-BRO001.35	A	0 / 54	S	6 / 54	S	1 / 54	S	/	/	/	/	29 / 51	N	/	/	/	/	/	/	/	/	3	T	/	/	/	/	/	/	/	Lead 95; Zinc 95,96; TBT																												
T-G15E	2-EBE000.40	A	0 / 49	S	5 / 49	S	1 / 48	S	/	/	/	/	6 / 46	S	/	/	/	/	/	/	/	/	3	T	/	/	/	/	/	/	/	TBT																												
T-G15E	2-ELI002.00	A	0 / 63	S	3 / 63	S	0 / 61	S	/	/	/	/	0 / 40	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	TBT																												
T-G15E	2-ELI003.17	A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	TBT																												
T-G15E	2-ELI006.33	A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	TBT																												
T-G15E	2-JMS005.72	A	0 / 64	S	0 / 64	S	1 / 63	S	/	/	/	/	0 / 39	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/																													
T-G15E	2-LAF000.00	A	0 / 48	S	0 / 48	S	0 / 48	S	/	/	/	/	0 / 47	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/																													
T-G15E	2-SBE000.57	A	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	TBT																												
T-G15E	2-SBE001.53	A	0 / 49	S	5 / 49	S	0 / 48	S	/	/	/	/	5 / 46	S	/	/	/	/	/	/	/	/	5	T	1	T	/	/	/	/	/	Sb 95; Pb, Zn 95,96; PCB 96, TBT																												
T-G15E	2-SBE002.30	A	0 / 33	S	3 / 33	S	0 / 33	S	/	/	/	/	2 / 32	S	/	/	/	/	/	/	/	/	5	T	/	/	/	/	/	/	/	Sb 95; Pb, Zn 95,96																												
T-G15E	2-SBE002.88	A	0 / 33	S	3 / 33	S	0 / 33	S	/	/	/	/	1 / 32	S	/	/	/	/	/	/	/	/	3	T	/	/	/	/	/	/	/	Sb, Pb, Zn 95; TBT																												
T-G15E	2-SBE004.61	A	1 / 32	S	2 / 32	S	0 / 32	S	/	/	/	/	1 / 32	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/																													
T-G15E	2-SBE005.48	A	1 / 32	S	2 / 32	S	0 / 32	S	/	/	/	/	0 / 32	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/																													
T-G15E	2-SBE008.40	A	0 / 33	S	2 / 33	S	0 / 33	S	/	/	/	/	0 / 32	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/																													
T-G15E	2-WBE000.56	A	0 / 33	S	0 / 33	S	0 / 33	S	/	/	/	/	1 / 33	S	/	/	/	/	/	/	/	/	2	T	/	/	/	/	/	/	/	Lead, Zn 95																												
T-G15E	LE5.4	A	/	/	/	/	/	/	/	/	/	/	0 / 67	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/																													
T-G15E	LE5.6	A	/	/	/	/	/	/	/	/	/	/	1 / 67	S	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/																													

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REG & W I B O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.			FISH TISSUE.			BIO MON	TYPE BIOL STN	COMMENTS																																																																																																																																																																																																																																															
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	IDENTIFICATION NUMBER	TYPE	TEMP	RESU	D.O.	RESU	pH	T LPS	R ESU	C H L P S	R ESU	B O L T M	C O L T M	B A C T E R I A	# c	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D				R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G E U A E L N D	R E X R C G 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			# VIOLATIONS / # SAMPLES						pH	TEMP	CHLOROPHYLL A	SOLUBLE FERTILIZER	RESISTANCE TO OXIDATION	EXTRACTABLE ORGANIC MATTER	MEASURED TOXICITY	RESISTANCE TO OXIDATION	EXTRACTABLE ORGANIC MATTER	MEASURED TOXICITY	RESISTANCE TO OXIDATION	EXTRACTABLE ORGANIC MATTER																																																																																																																																																																																																																																																																																																																																					
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Roanoke River Basin
Appendix B for the 1998 305(b) and 303(d) Reports

Region	G & W I B O I N D	Monitoring Stations		Conventional Water Column Monitoring Data						Other Monitoring Data										Sediment				Fish Tissue				Bio Mon	Type Biol Stn	Comments						
		Identification Number	Type	# Violations / # Samples						Total	pH	TOC	Phosphorus	Heavy Metals	Chlorophyll	Fertilizer	Bacteria	#b	#c	#d	#e	#f	#g													
				Temp	D.O.	Turbidity	pH	TOC	Phosphorus															Heavy Metals	Chlorophyll	Fertilizer	Bacteria				#b	#c	#d	#e	#f	#g
W-L01R	4ARSF006.60	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S									
W-L01R	4ARSF011.52	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S									
W-L01R	4ARSF002.20	A	1	/ 20	S	0 / 20	S	0 / 20	S	0 / 0	0	0 / 0	0	0 / 0	2	/ 20	S	0	S	0	S	0	S	0	S	0	S									
W-L02R	4AWLN000.40	A	0	/ 19	S	0 / 19	S	0 / 19	S	0 / 0	0	0 / 0	0	0 / 0	7	/ 20	P	0	S	0	S	0	S	0	S	0	S			Nut. Enrich. Policy						
W-L02R	4ARNF015.09	A	0	/ 0	J	0 / 0	J	0 / 0	J	0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			No samples collected						
W-L02R	4ARNF013.60	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S									
W-L02R	4ARNF002.97	A	0	/ 19	S	0 / 19	S	0 / 19	S	0 / 0	0	0 / 0	0	0 / 0	1	/ 19	S	0	S	0	S	0	S	0	S	0	S			Nut. Enrich. Policy						
W-L03R	4AROA227.42	A	0	/ 59	S	0 / 59	S	0 / 59	S	3 / 60	T	0 / 0	0	0 / 0	8	/ 60	S	0	S	0	S	1	T	0	S	0	S			Nut. Enrich. Policy - Ag in sed.						
W-L03R	4AROA224.54	B	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	T	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			Nut. Enrich. Policy						
W-L03R	4AROA219.99	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S			Level 2 PCB contamination						
W-L03R	4AROA212.17	A,B	0	/ 59	S	0 / 59	S	0 / 59	S	2 / 60	T	0 / 0	0	0 / 0	4	/ 60	S	0	S	0	S	0	S	0	S	0	S			Nut. Enrich. Policy						
W-L03R	4AROA216.34	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S									
W-L04R	4AROA206.95	B	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	T	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			Nut. Enrich. Policy						
W-L04R	4AROA202.20	A,B	0	/ 59	S	0 / 59	S	0 / 59	S	3 / 59	T	0 / 0	0	0 / 0	22	/ 60	N	0	S	0	S	1	T	0	S	0	S			Nut. Enrich. Policy - Pb in sed.						
W-L04R	4AROA199.20	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S			Level 2 PCB/Chlordane contamination						
W-L04R	4APEE001.04	A	0	/ 13	S	0 / 13	S	0 / 13	S	0 / 2	J	0 / 0	0	0 / 0	0	/ 12	J	0	S	0	S	0	S	0	S	0	S			Ext. Period-Nut. Enrich. Policy						
W-L04R	4APEE000.00	A	0	/ 1	J	0 / 1	J	0 / 0		0 / 0	0	0 / 0	0	0 / 0	1	/ 1	J	0	S	0	S	0	S	0	S	0	S			Sta. discount'd 8/92						
W-L04R	4AORE000.19	A	0	/ 8	J	0 / 8	J	0 / 8	J	0 / 0	0	0 / 0	0	0 / 0	2	/ 8	J	0	S	0	S	0	S	0	S	0	S			Sta. discount'd 5/94						
W-L04R	4AROA198.04	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S	0	S									
W-L04R	4AMSN012.62	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0		0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L04R	4AMSN006.92	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	0	0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L04R	4AMSN003.36	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	0	0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L04R	4AMSN002.36	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	0	0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L04R	4AMSN000.67	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	0	0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4AGLA008.10	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	0	0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4AGLA005.75	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	0	0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4AGLA004.39	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	0	0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4AGLA001.60	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	0	0	0	0	0	0	0	0	0			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4ATKR016.64	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4ATKR012.28	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4ATKR005.68	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4ATKR001.80	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4ATKR000.69	A	10	/ 59	P*	0 / 59	S	0 / 59	S	1 / 59	S	0 / 0	0	0 / 0	25	/ 60	N	0	S	0	S	0	S	0	S	0	S			Natural Conditions & Nut. Enrich. P.						
W-L05R	4ALCK000.38	A	0	/ 21	S	0 / 21	S	1 / 21	S	0 / 0	0	0 / 0	0	0 / 0	13	/ 21	N	0	S	0	S	0	S	0	S	0	S			SS 975101 - NPS Nut. Enrich. P.						
W-L05R	4AGLA000.20	A	0	/ 8	J	0 / 8	J	0 / 8	J	0 / 0	0	0 / 0	0	0 / 0	3	/ 8	P	0	S	0	S	0	S	0	S	0	S			SS 975101 Sta. discount'd 6/94						
W-L05R	4ACOO000.16	SS	/	/	/	/	/	/	/	/	/	/	/	/	0	/ 0	J	0	S	0	S	0	S	0	S	0	S			SS 975101 - NPS Nut. Enrich. P.						
W-L06R	4ABAA019.50	B	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			Last RBP II Surv. Spr. '96						
W-L06R	4ABAA002.61	A	0	/ 13	S	0 / 13	S	0 / 13	S	0 / 2	J	0 / 0	0	0 / 0	0	/ 12	J	0	S	0	S	0	S	0	S	0	S			Ext. Period						
W-L06R	4ABAA000.03	A	0	/ 1	J	0 / 1	J	0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 1	J	0	S	0	S	0	S	0	S	0	S			Station discount'd 8/92						
W-L07R	4AROA192.55	A	0	/ 57	S	0 / 57	S	0 / 57	S	3 / 57	S	0 / 0	0	0 / 0	14	/ 58	P	0	S	0	S	0	S	0	S	0	S									
W-L07R	4ABDA003.63	A	0	/ 16	S	0 / 16	S	0 / 15	S	0 / 0	0	0 / 0	0	0 / 0	3	/ 16	T	0	S	0	S	1	T	0	S	0	S			Sb exceeds in sed.						
W-L07R	4ABEA002.82	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/										
W-L08R	4ATEL001.02	B	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			NI IMP						
W-L08R	4ALLE005.22	B	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			J IMP						
W-L08R	4AGCR000.01	B	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			NI REF						
W-L08R	4ABWR061.20	A,B	0	/ 14	S	0 / 14	S	0 / 14	S	0 / 3	J	0 / 0	0	0 / 0	11	/ 15	N	0	S	0	S	1	T	0	S	0	S			MI IMP						
W-L08R	4ABWR045.80	A,B	0	/ 14	S	0 / 14	S	0 / 14	S	0 / 5	S	0 / 0	0	0 / 0	7	/ 14	N	0	S	0	S	0	S	0	S	0	S			MI IMP						
W-L08R	4ABSF001.15	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			SS 925102 - Ag. NPS						
W-L08R	4ABNR009.36	B	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			J IMP						
W-L08R	4ABNR004.56	SS	0	/ 0		0 / 0		0 / 0		0 / 0	0	0 / 0	0	0 / 0	0	/ 0		0	S	0	S	0	S	0	S	0	S			SS 925102 - Ag. NPS						

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Roanoke River Basin
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Roanoke River Basin
Appendix B for the 1998 305(b) and 303(d) Reports

REG & WIOB ID	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS										
	IDENTIFICATION NUMBER	TYPE	TEMP	D.O.	T	pH	TOL	PHOS	RUT	CHL	RUT	FOL	BACT	#b	#c	#d	#e	#f	#g																				
W-L08R	4ABNR000.40	B	0	/	0	0	/	0	0	/	0	0	0	/	0	0	S	0	S	0	S	0	S	0	S	0	S	0	S	0	S	0	S	VI	IMP	SS 925102 - Ag. NPS - Dairy			
W-L09R	4AMEE021.13	SS	0	/	0	0	/	0	0	/	0	0	0	/	0	0	S	0	S	0	S	0	S	0	S	0	S	0	S	0	S	0	S			SS 925102 - Ag. NPS			
W-L09R	4AMEE007.85	SS	0	/	0	0	/	0	0	/	0	0	0	/	0	0	S	0	S	0	S	0	S	0	S	0	S	0	S	0	S	0	S			SS 925102 - Ag. NPS			
W-L09R	4AMEE002.38	A,B	0	/	19	S	0	/	19	S	0	/	19	S	0	/	2	J	0	/	0	S	1	T	0	S	1	T	0	S	1	T	0	S	NI	IMP	AQM & SS925102- Ag. NPS Sb in se		
W-L10R	4ABWR019.75	A	0	/	56	S	0	/	56	S	1	/	56	S	4	/	57	S	0	/	0	S	9	/	57	P	0	S	0	S	1	T	0	S			AQM & SS925102 - Ag. NPS		
W-L10R	4ABWR019.75	C		/			/			/		/				/			/				/													Level 2 PCB contamination			
W-L11R	4AGIL023.22	A	0	/	13	S	0	/	13	S	0	/	13	S	0	/	1	J	0	/	0	S	9	/	14	N	0	S	0	S	0	S	0	S	0	S	J	IMP	AQM & SS 925102 - Ag. NPS
W-L11R	4AGIL008.30	B	0	/	0	0	/	0	0	/	0	0	0	/	0	0	S	0	S	0	S	0	S	0	S	0	S	0	S	0	S	0	S			Last RBP II Surv. Fall '93 - "SI"			
W-L12L	4ABRW003.65	C		/			/			/		/				/			/				/																
W-L12L	4AROA158.22	C		/			/			/		/				/			/				/																
W-L12L	4AROA163.54	C		/			/			/		/				/			/				/																
W-L12L	4AROA198.50	SS		/			/			/		/				/			/				/																
W-L13R	4AOWC005.36	A	0	/	16	S	0	/	16	S	0	/	16	S	0	/	0		0	/	0	S	3	/	15	T	0	S	0	S	1	T	0	S			Ag in sediment		
W-L14R	4ASDA009.79	A	0	/	35	S	0	/	35	S	0	/	35	S	0	/	24	S	0	/	0	S	10	/	35	P	0	S	0	S	1	T	0	S			Abv. Ferrum STP Ag in sed.		
W-L14R	4ASDA009.77	A	0	/	59	S	0	/	59	S	0	/	59	S	7	/	59	S	0	/	0	S	11	/	60	P	0	S	0	S	0	S	0	S	0	S			
W-L14R	4APGG052.73	A	0	/	39	S	0	/	39	S	0	/	39	S	1	/	39	S	0	/	0	S	11	/	40	P	0	S	0	S	0	S	0	S	0	S			
W-L15R	4ACNT001.32	A	0	/	3	J	0	/	3	J	0	/	3	J	0	/	0		0	/	0	S	0	/	3	J	0	S	0	S	0	S	0	S	0	S			
W-L16R	4APGG030.62	A	0	/	13	S	0	/	13	S	0	/	13	S	0	/	2	W	0	/	0	S	1	/	12	J	0	S	0	S	0	S	0	S	0	S			Ext. Period
W-L16R	4APGG032.21	SS		/			/			/		/				/			/				/																
W-L17R	4ASNW000.60	A	0	/	18	S	0	/	18	S	0	/	18	S	0	/	0		0	/	0	S	4	/	19	T	0	S	0	S	0	S	0	S	0	S			
W-L18R	4APGG003.29	A	0	/	27	S	0	/	27	S	0	/	26	S	0	/	13	S	0	/	0	S	7	/	28	P	0	S	0	S	0	S	0	S	0	S			
W-L18R	4APGG003.29	C		/			/			/		/				/			/				/																
W-L19R	4ASCE000.26	A	0	/	20	S	0	/	20	S	0	/	20	S	0	/	0		0	/	0	S	3	/	20	T	0	S	0	S	0	S	0	S	0	S			Level 2 PCB contamination
W-L19R	4AROA129.55	A	0	/	28	S	0	/	28	S	0	/	28	S	0	/	13	S	0	/	0	S	1	/	28	S	0	S	0	S	0	S	0	S	0	S			
W-L19R	4AFRZ000.20	A	0	/	20	S	0	/	20	S	0	/	20	S	0	/	0		0	/	0	S	1	/	20	S	0	S	0	S	0	S	0	S	0	S			
W-L20R	4AGSE037.78	A	0	/	15	S	0	/	14	S	1	/	15	S	1	/	2	J	0	/	0	S	1	/	14	S	0	S	0	S	0	S	0	S	0	S			Ext. Period
W-L21R	4AGSE022.55	A	0	/	13	S	0	/	13	S	0	/	13	S	0	/	2	J	0	/	0	S	2	/	12	J	0	S	0	S	0	S	0	S	0	S			Ext. Period
W-L22R	4AGSE000.20	A	0	/	18	S	0	/	18	S	0	/	18	S	0	/	0		0	/	0	S	2	/	19	T	0	S	0	S	1	T	0	S	0	S			Sb in sed.
W-L23R	4ASEE003.16	A	0	/	16	S	0	/	16	S	0	/	16	S	0	/	0		0	/	0	S	11	/	16	N	0	S	0	S	0	S	0	S	0	S			
W-L24R	4ABNF001.06	A	0	/	13	S	0	/	13	S	0	/	13	S	0	/	2	J	0	/	0	S	1	/	12	J	0	S	0	S	1	T	0	S	0	S			Ext. Period - Sb in sed.
W-L25R	4AECR003.02	A	0	/	17	S	0	/	17	S	0	/	17	S	0	/	0		0	/	0	S	5	/	17	P	0	S	0	S	0	S	0	S	0	S			
W-L26R	4AMCR004.60	A	0	/	13	S	0	/	13	S	0	/	12	J	0	/	0		0	/	0	S	8	/	13	N	0	S	0	S	0	S	0	S	0	S			
W-L26R	4ALOR014.75	A,B	0	/	58	S	0	/	58	S	0	/	58	S	2	/	58	S	0	/	0	S	14	/	59	P	0	S	0	S	1	T	0	S	0	S	NI	REF	Abv. Bedford STP Zn in sed.
W-L26R	4ALOR014.33	A,B	0	/	11	J	0	/	11	J	0	/	11	J	9	/	11	T	0	/	0	S	4	/	11	T	0	S	0	S	0	S	0	S	0	S	NI	IMP	Below Bedford STP
W-L26R	4ALOR010.78	A	0	/	35	S	0	/	35	S	0	/	35	S	17	/	36	T	0	/	0	S	10	/	37	P	0	S	0	S	0	S	0	S	0	S			Below Bedford STP
W-L26R	4ALOR008.64	A	0	/	15	S	0	/	15	S	0	/	15	S	7	/	15	T	0	/	0	S	5	/	15	P	0	S	0	S	0	S	0	S	0	S			Ext. Period
W-L27R	4ABOR016.26	A	0	/	4	J	0	/	4	S	0	/	4	J	0	/	0		0	/	0	S	3	/	4	T	0	S	0	S	0	S	0	S	0	S			
W-L28R	4ABOR012.18	B	0	/	0	J	0	/	0	J	0	/	0	J	0	/	0		0	/	0	S	0	/	0	S	0	S	0	S	0	S	0	S	0	S			
W-L28R	4ABOR000.62	A	0	/	52	S	0	/	52	S	0	/	52	S	3	/	48	S	0	/	0	S	12	/	53	P	0	S	0	S	0	S	0	S	0	S			Last RPB II Surv. Fall 1992 -" NI"
W-L28R	4AOER003.18	SS		/			/			/		/				/			/				/																
W-L28R	4AOER011.27	SS		/			/			/		/				/			/				/																
W-L29R	4AFCA001.40	A	0	/	14	S	0	/	14	S	0	/	13	S	0	/	1	J	0	/	0	S	1	/	12	J	0	S	0	S	0	S	0	S	0	S			Ext. Period
W-L30R	4ASEN000.40	A	0	/	19	S	0	/	19	S	0	/	18	S	0	/	0		0	/	0	S	2	/	18	T	0	S	0	S	0	S	0	S	0	S			
W-L30R	4AROA108.09	A	0	/	13	S	0	/	13	S	0	/	13	S	0	/	13	S	0	/	0	S	1	/	12	J	0	S	0	S	0	S	0	S	0	S			
W-L30R	4AROA108.09	SS		/			/			/		/				/			/				/																
W-L30R	4AROA097.46	A	0	/	58	S	0	/	58	S	0	/	58	S	2	/	58	S	0	/	0	S	11	/	59	P	0	S	0	S	0	S	0	S	1	P			VDH Fish Advisory
W-L30R	4AROA097.07	SS		/			/			/		/				/			/				/																
W-L30R	4ACOR000.21	A	0	/	7	J	0	/	7	J	0	/	6	J	0	/	0		0	/	0	S	0	/	7	J	0	S	0	S	0	S	0	S	1	P			VDH Fish Advisory
W-L30R	4ACRE002.52	A	0	/	20	S	0	/	20	S	0	/	20	S	1	/	20	S		/			/																
W-L30R	4AROA099.22	SS		/			/			/		/				/			/				/																
W-L30R	4AROA112.72	SS		/			/			/		/				/			/				/																
W-L30R	4AROA117.49	SS		/			/			/		/				/			/				/																
W-L30R	4AROA122.31	SS		/			/			/		/				/			/				/																

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Roanoke River Basin
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REG & W I B O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA					OTHER MONITORING DATA										SEDIMENT.				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS						
																		#d		#e		#f		#g										
	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T				R	T	R	T	R	T
	IDENTIFICATION NUMBER	TYPE	TEMP	DO	pH	T	PH	OR	U	OH	U	OR	U	OR	U	OR	U	OR	U	OR	U	OR	U	OR	U				OR	U	OR	U	OR	U
P-L41R	4ADFF002.02	A	0 / 20	S	0 / 20	S	0 / 20	S	1 / 20	S	/	/	4 / 20	T						0	S	0	S											
P-L62R	4ADAN036.58	A	0 / 8	J	0 / 8	J	0 / 8	J	1 / 8	J	/	/	2 / 8	J						--	S	--	S											
P-L62R	4ADAN042.80	A	0 / 36	S	0 / 36	S	0 / 36	S	6 / 37	S			18 / 35	N						0	S	0	S											
P-L62R	4ADBC002.19	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/	/	2 / 11	J						0	S	0	S											
P-L63R	4ABIR001.00	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 20	S	/	/	5 / 19	P						--	S	--	S											
P-L64R	4ADAN015.30	A	0 / 60	S	0 / 60	S	0 / 60	S	9 / 59	S	/	/	21 / 59	N						--	S	--	S											
P-L64R	4ALSN001.04	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 8	J	/	/	1 / 8	J						0	S	0	S											
P-L67R	4ABAN023.28	A	0 / 20	S	0 / 20	S	1 / 20	S	1 / 19	S	/	/	8 / 21	P						--	S	--	S											
P-L70R	4ASNA000.20	A	0 / 20	S	0 / 20	S	1 / 20	S	1 / 9	J	/	/	4 / 20	T						--	S	--	S											
P-L71R	4ABAN005.58	A	0 / 60	S	0 / 60	S	1 / 60	S	2 / 59	S	/	/	14 / 60	P						--	S	--	S											
P-L72R	4ATRR001.92	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/	/	2 / 13	T						0	S	0	S											
P-L73R	4AAAR004.72	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 20	S	/	/	1 / 20	S						0	S	0	S											
P-L74R	4AHYC002.70	A	0 / 60	S	0 / 60	S	0 / 60	S	1 / 59	S	/	/	5 / 59	S						--	S	--	S											
P-L75R	4ABEE000.80	A	0 / 7	J	0 / 7	J	0 / 7	J	0 / 7	J	/	/	0 / 7	J						0	S	0	S											
P-L75R	4ABHB008.63	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/	/	0 / 12	J						0	S	0	S											
P-L76R	4ALFF001.85	A	0 / 8	J	0 / 8	J	0 / 8	J	1 / 8	J	/	/	2 / 8	T						--	S	--	S											
P-L77R	4ABST009.35	A	0 / 12	J	1 / 12	J	0 / 12	J	0 / 12	J	/	/	0 / 12	J						0	S	0	S											
P-L77R	4ALNE006.56	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 19	S	/	/	0 / 19	S						0	S	0	S											
P-L78R	4AALN009.12	A	0 / 20	S	1 / 21	S	0 / 21	S	0 / 19	S	/	/	1 / 19	S						0	S	0	S											
P-L78R	4AROA018.04	A	0 / 63	S	20 / 63	N	0 / 63	S	0 / 58	S	/	/	2 / 56	S						--	S	--	S											
P-L79R	4AFLT008.79	A	0 / 60	S	4 / 60	S	0 / 60	S	50 / 60	T	/	/	17 / 59	P						--	S	--	S											
P-L79R	4AFLT008.79	B	/	/	/	/	/	/	/	/	/	/	/	/																				
P-L79R	4AFLT009.17	B	/	/	/	/	/	/	/	/	/	/	/	/																				
P-L79R	4AMES004.78	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/	/	1 / 11	J						0	S	0	S											
P-L79R	4AROA012.08	A	0 / 8	J	5 / 8	N	0 / 8	J	0 / 5	J	/	/	0 / 5	J						--	S	--	S											
P-L80R	4AGRT003.82	A	0 / 12	J	1 / 12	J	0 / 12	J	0 / 12	J	/	/	4 / 11	T						--	S	--	S											
P-L81R	4APOB006.35	A	0 / 12	J	1 / 12	J	0 / 12	J	0 / 12	J	/	/	0 / 11	J						--	S	--	S											
P-L82R	4APHC006.38	A	0 / 12	J	1 / 12	J	0 / 12	J	0 / 12	J	/	/	1 / 11	J						0	S	0	S											

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REGION	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS
	ID	NUMBER	TYPE	# VIOLATIONS / # SAMPLES						TOL	PHOS	THORUS	CHLOR	EUPH	SOL	COL	BACT	#b	#c	#d	#e	#f	#g						
				TEMP	RES	DO	T	pH	T																				
				TEMP	RES	DO	T	pH	T																				
P-K01R	5AMMR000.69	A	0 / 19	S	0 / 19	S	1 / 19	S	1 / 19	S	/				2 / 18	T				0 S	0 S								
P-K02R	5ABJC004.90	A	0 / 7	J	1 / 7	J	1 / 7	J	1 / 7	J	/				1 / 7	J				0 S	0 S								
P-K02R	5ANMR013.95	A	0 / 19	S	0 / 19	S	1 / 19	S	1 / 19	S	/				3 / 18	T				0 S	0 S								
P-K03R	5AFRC002.98	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 19	S	/				2 / 19	T				0 S	0 S								
P-K04R	5ASNY000.65	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/				1 / 12	J				0 S	0 S								
P-K05R	5AGTO001.16	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 8	J	/				0 / 8	J				0 S	0 S								
P-K05R	5AMHN082.13	A	0 / 60	S	0 / 60	S	0 / 60	S	2 / 60	S	/				9 / 59	T													
P-K06R	5AGTC005.40	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 20	S	/				3 / 20	T				0 S	0 S								
P-K07R	5ARSE001.22	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/				6 / 11	P				0 S	0 S								
P-K07R	5ARSE006.68	B	/		/		/		/		/				/										MI	NET	STP solids Fall '93, Spring '94.		
P-K07R	5ARSE009.87	B	/		/		/		/		/				/										NI	REF	Reference, Alberta STP		
P-K08R	5AMHN068.30	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 12	J	/				2 / 12	J				0 S	0 S								
P-K08R	5ARDC003.33	A	0 / 12	J	0 / 12	J	0 / 12	J	1 / 12	J	/				0 / 12	J				0 S	0 S								
P-K09R	5AMHN052.34	A	0 / 61	S	8 / 61	T	0 / 61	S	0 / 59	S	/				6 / 60	S													
P-K10R	5ARSK003.08	A	0 / 12	J	1 / 12	J	0 / 12	J	0 / 12	J	/				1 / 12	J				0 S	0 S								
P-K11R	5AFON022.04	A	0 / 20	S	1 / 20	S	0 / 20	S	0 / 20	S	/				0 / 20	S				0 S	0 S								
P-K12R	5AFON006.07	A	0 / 13	S	6 / 14	Z	0 / 14	S	1 / 12	J	/				1 / 11	J				0 S	0 S						Natural Conditions		
P-K14R	5ABHC003.73	A	0 / 19	S	0 / 19	S	1 / 19	S	2 / 20	S	/				4 / 19	T				0 S	0 S								
P-K14R	5ANTW136.52	A	0 / 22	S	1 / 22	S	2 / 22	S	1 / 23	S	/				0 / 22	S													
P-K14R	5ANTW155.06	A	0 / 12	J	0 / 12	J	1 / 12	J	1 / 11	J	/				3 / 12	T				0 S	0 S								
P-K15R	5ALNT004.68	A	0 / 20	S	0 / 20	S	0 / 20	S	2 / 20	S	/				4 / 20	T													
P-K16R	5ABPC000.12	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 11	J	/				6 / 12	T				0 S	0 S								
P-K16R	5ACKD000.40	A	0 / 8	J	0 / 8	J	0 / 8	J	0 / 8	J	/				0 / 8	J					0 S								
P-K16R	5AXBL000.80	B	/		/		/		/		/				/										MI	NET	Erosion and sedimentation		
P-K16R	5AXBL001.18	B	/		/		/		/		/				/										NI	REF	Reference, Blackstone STP		
P-K17R	5ANTW109.02	A	0 / 60	S	0 / 60	S	1 / 60	S	0 / 59	S	/				4 / 59	S				0 S									
P-K17R	5AWAQ001.40	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 11	J	/				3 / 12	J					0 S	0 S							
P-K18R	5ASTG005.96	A	0 / 20	S	2 / 20	S	1 / 20	S	0 / 19	S	/				1 / 20	S													
P-K19R	5ABSK006.52	A	0 / 8	J	3 / 8	Z	0 / 8	J	0 / 8	J	/				0 / 8	J											Natural Conditions		
P-K19R	5ANTW073.91	B	/		/		/		/		/				/										NI	REF	Reference, 5th order stream		
P-K19R	5ANTW078.20	A	0 / 60	S	0 / 60	S	0 / 60	S	0 / 59	S	/				4 / 60	S				0 S									
P-K20R	5ABTR002.80	A	0 / 13	S	3 / 13	Z	0 / 13	J	0 / 11	J	/				0 / 12	J				0 S	0 S						Natural Conditions		
P-K21R	5ASTO001.20	A	0 / 21	S	0 / 21	S	2 / 21	S	0 / 20	S	/				2 / 20	S													
P-K22R	5ASAP013.69	A	0 / 13	S	3 / 13	T	0 / 13	S	1 / 11	J	/				2 / 12	T													
P-K23R	5ANBT001.26	A	0 / 23	S	8 / 23	Z	2 / 23	Z	0 / 20	S	/				2 / 20	S											Natural Conditions		
P-K23R	5AROW002.41	A	0 / 10	J	2 / 10	Z	5 / 10	Z	0 / 8	J	/				1 / 8	J				0 S	0 S						Natural Conditions		
P-K23R	5AROW013.14	A	0 / 14	S	5 / 14	Z	5 / 14	Z	0 / 12	J	/				1 / 12	J				0 S	0 S						Natural Conditions		
P-K24R	5ANTW045.45	A	0 / 37	S	1 / 37	S	1 / 37	S	1 / 37	S	/				3 / 36	S													
P-K25R	5ARCN003.36	A	0 / 23	S	9 / 23	Z	18 / 23	Z	0 / 20	S	/				3 / 20	T				0 S	0 S						Natural Conditions		
P-K26R	5ATRE026.75	A	0 / 22	S	9 / 22	Z	1 / 22	S	0 / 20	S	/				2 / 20	S				0 S	0 S						Natural Conditions		
P-K29R	5AASM003.00	A	0 / 2	J	1 / 2	Z	1 / 2	Z	0 / 2	J	/				0 / 2	J											Natural Conditions		
P-K29R	5AASM013.36	A	0 / 20	S	8 / 21	Z	8 / 21	Z	0 / 19	S	/				4 / 20	T											Natural Conditions		
P-K31R	5ABLW092.62	A	0 / 15	S	6 / 15	Z	9 / 15	Z	0 / 11	J	/				1 / 12	J				0 S	0 S						Natural Conditions		
P-K31R	5AWKS001.00	A	0 / 13	S	8 / 13	Z	6 / 13	Z	0 / 8	J	/				0 / 8	J											Natural Conditions		
P-K31R	5AWKS009.11	A	0 / 16	S	3 / 16	Z	15 / 16	Z	0 / 11	J	/				2 / 14	T				0 S	0 S						Natural Conditions		
P-K32R	5ABLW058.22	A	0 / 64	S	23 / 64	Z	12 / 64	Z	0 / 57	S	/				8 / 58	S											Natural Conditions		
P-K32R	5ABLW074.44	A	0 / 64	S	26 / 64	Z	13 / 64	Z	2 / 58	S	/				8 / 59	S											Natural Conditions		
P-K32R	5ACPP003.20	A	0 / 25	S	15 / 25	Z	8 / 25	Z	0 / 20	S	/				1 / 21	S											Natural Conditions		
P-K32R	5ASRN000.65	B	/		/		/		/		/				/										VI	NET	Bryants Pond algae, discharges		

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REGION & WATER BODY	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA					OTHER MONITORING DATA										SEDIMENT.				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS
	IDENTIFICATION NUMBER	TYPE	TEMP	SUL	D.O.	pH	TOL	PHOS	ELOS	CHLP	ELOS	COLI	BACT	#b	#c	#d	#e	#f	#g									
P-K32R	5ASRN001.24	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	NET	Upstream STP, long term degr.						
P-K32R	5ASRN002.66	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	NET	Erosion and sedimentation						
P-K32R	5ASRN002.96	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	REF	Reference, Spring Branch disch.						
P-K33R	BLW053.01	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S							
T-K13R	5AMHN023.40	A	0 / 59	S	0 / 59	S	5 / 58	S	0 / 58	S	/	3 / 58	S															
T-K13R	5ATRR002.50	A	0 / 59	S	13 / 59	Z	7 / 58	S	0 / 58	S	/	3 / 58	S										Natural Conditions					
T-K27R	5ATRE008.48	B	0 / 25	S	7 / 25	Z	6 / 25	Z	1 / 25	S	/	2 / 25	S							NI		Sampled Fall 1995& Natural Conditions						
T-K27R	5ATRE016.02	A/B	0 / 25	S	6 / 25	Z	6 / 25	Z	0 / 25	S	/	1 / 24	S							NI		Natural Conditions						
T-K28R	02047000	A	0 / 22	S	4 / 21	S	0 / 21	S	0 / 21	S	/	0 / 0	W									USGS Station						
T-K28R	5ANTW015.99	A	0 / 56	S	0 / 56	S	2 / 55	S	9 / 55	T	/	2 / 55	S															
T-K28R	5ANTW016.18	B	0 / 2	J	0 / 2	J	0 / 2	J	1 / 2	J	/	0 / 2	J							NI		Last sampled in Spring 1994						
T-K28R	NTW-017.99	C	/	/	/	/	/	/	/	/	/	/	/							0	S							
T-K28R	5ANTW035.44	A	0 / 23	S	0 / 23	S	1 / 23	S	0 / 23	S	/	0 / 23	S															
T-K29R	5AASM008.12	A	0 / 10	J	1 / 10	J	2 / 10	J	1 / 11	J	/	1 / 11	J															
T-K30R	5ADMR008.42	A	0 / 19	S	2 / 19	Z	1 / 19	S	0 / 20	S	/	1 / 20	S															
T-K30R	5ANTW000.98	C	/	/	/	/	/	/	/	/	/	/	/							2	T	PAHs, Organics in fish tissue 1996						
T-K30R	5ANTW003.30	A	0 / 59	S	1 / 59	S	2 / 58	S	1 / 58	S	/	0 / 59	S															
T-K30R	5ANTW015.60	B	0 / 3	J	0 / 3	J	0 / 3	J	1 / 3	J	/	0 / 3	J							NI		Natural Conditions						
T-K33R	5ABLW040.22	A	0 / 51	S	11 / 51	Z	3 / 51	S	0 / 51	S	/	2 / 51	S									Natural Conditions						
T-K34R	5AMSW006.77	A	0 / 13	S	8 / 13	Z	2 / 13	Z	0 / 12	J	/	3 / 12	J									Natural Conditions						
T-K34R	5ARKN006.40	A	0 / 34	S	13 / 34	Z	9 / 34	Z	0 / 34	S	/	4 / 34	S									Natural Conditions						
T-K35R	5ASCK006.96	A	0 / 21	S	4 / 21	S	8 / 21	Z	0 / 22	S	/	1 / 22	S									Natural Conditions						
T-K35R	5ASCK018.65	A	0 / 13	S	8 / 13	Z	6 / 13	Z	/	/	/	1 / 12	J															
T-K36R	02049500	A	0 / 20	S	2 / 19	Z	3 / 19	Z	0 / 19	S	/	0 / 0	W									USGS Station Natural Conditions						
T-K36R	5ABLW000.60	B/C	/	/	/	/	/	/	/	/	/	/	/							3	T	PAHs, Organics in fish tissue 1996						
T-K36R	5ABLW001.10	B	/	/	/	/	/	/	/	/	/	/	/							NI								
T-K36R	5ABLW009.14	A	0 / 59	S	13 / 59	Z	3 / 58	S	0 / 58	S	/	2 / 59	S									Natural Conditions						
T-K36R	BLW010.08	C	/	/	/	/	/	/	/	/	/	/	/															
T-K36R	BLW016.93	C	/	/	/	/	/	/	/	/	/	/	/															
T-K36R	5ABLW022.84	A/C	0 / 47	S	1 / 47	S	13 / 47	Z	0 / 47	S	/	2 / 47	S			1	T			0	S	Nickel 1996 & Natural Conditions						
T-K37R	5AXDN000.48	A	0 / 10	J	1 / 10	J	9 / 10	Z	1 / 11	J	/	1 / 11	J									Natural Conditions						
T-K38R	5ASTN008.78	A/B	0 / 62	S	18 / 62	Z	17 / 61	Z	0 / 61	S	/	3 / 62	S							NI		Natural Conditions						
T-K39R	5BXC000.00	A	0 / 57	S	9 / 57	S	54 / 56	Z	1 / 55	S	/	1 / 54	S									Natural Conditions						
T-K40R	5BIND001.15	A	0 / 21	S	8 / 21	T	1 / 21	S	15 / 19	T	/	4 / 20	T															
T-K40R	5BNTW011.90	A	0 / 56	S	19 / 56	Z	12 / 56	Z	2 / 54	S	/	1 / 53	S			1	T					Beryllium 1995 & Natural Conditions						
T-K41R	5BBKW002.50	A	0 / 21	S	1 / 21	S	0 / 21	S	2 / 20	S	/	1 / 20	S															
T-K41R	5BMLD001.92	A	0 / 21	S	4 / 21	S	1 / 21	S	4 / 20	T	/	2 / 19	J															
T-K41R	5BNLR000.00	A	0 / 11	J	0 / 11	J	0 / 10	J	0 / 11	J	/	0 / 13	S															
T-K41R	5BNLR002.11	A	0 / 12	J	0 / 12	J	0 / 11	J	0 / 12	J	/	0 / 13	S															
T-K41R	5BNLR003.83	A	0 / 10	J	0 / 11	J	0 / 10	J	0 / 10	J	/	0 / 12	J															
T-K41R	5BNLR005.56	A	0 / 33	S	1 / 33	S	3 / 32	S	1 / 32	S	/	1 / 33	S															
T-K41R	5BNLR007.56	A	0 / 10	J	0 / 10	J	0 / 9	J	0 / 11	J	/	0 / 12	J															
T-K41R	5BNLR010.25	A	0 / 11	J	0 / 11	J	0 / 10	J	0 / 11	J	/	0 / 13	S			1	T					Antimony 1995						
T-K41R	5BNLR010.75	A	0 / 10	J	1 / 10	J	0 / 9	J	0 / 11	J	/	0 / 13	S															
T-K41R	5BNLR013.61	A	0 / 57	S	7 / 57	S	1 / 57	S	4 / 57	S	/	5 / 54	S			2	T					Cadmium, Pb 1995						
T-K41R	5BPCT001.79	A	0 / 21	S	7 / 21	T	0 / 21	S	3 / 20	T	/	3 / 20	T															
T-K41R	5BWNC001.73	A	0 / 53	S	0 / 53	S	0 / 53	S	10 / 53	T	/	4 / 51	S			2	T					Be, Pb 1995						
T-K41R	5BWNC003.65	A	0 / 57	S	10 / 47	Z	3 / 55	S	7 / 54	S	/	1 / 44	S									Natural Conditions						
T-K41R	5BWNC010.02	A	0 / 22	S	2 / 22	S	0 / 22	S	4 / 22	S	/	12 / 22	N															

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		MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.				FISH TISSUE.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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REG ION	MONITORING STATIONS	CONVENTIONAL WATER COLUMN MONITORING DATA							OTHER MONITORING DATA										SEDIMENT.				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS					
		# VIOLATIONS / # SAMPLES							T O T A L	P H	E S U L T	C O L I T E R I A L	B A C T E R I A L	# b	# c	# d	# e	# f	# g															
		T Y P E	T E M P	R E S U L T	D.O.	R E S U L T	pH	T O T A L												P H	E S U L T	C H L O R O L A	R E S U L T	C O L I T E R I A L	B A C T E R I A L	# b				# c	# d	# e	# f	# g
S-P20R	6BSRA000.40	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI					
S-P20R	6BSRA001.11	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 19	S	0 / 0	W	7 / 13	N																	Ni			
S-P20R	6BPWL001.62	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/					
S-P20L	6BPWL025.32	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/					
S-P21R	6BPOW128.37	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/					
S-P21R	Beatie Creek	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	Special Study			
S-P21R	6BPOW138.91	A	0 / 28	S	0 / 28	S	0 / 28	S	0 / 28	S	0 / 0	W	1 / 19	S																				
S-P22R	6BWAL001.57	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net			
S-P23R	6BMTN003.56	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	ref			
S-P23R	6BPOW121.15	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-P23R	6APOW121.76	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/					
S-P24R	6BIND010.25	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-P24R	6BIND009.10	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/					
S-Q01R	6ADRK036.38	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-Q01R	6AHRP000.63	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net			
S-Q03R	6AKOX008.11	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		Currently listed as Threatened			
S-Q03R	6AKOX008.11	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 19	S	0 / 0	W	2 / 14	T							0	S	1	S	0	S					Ni/FC thru 10-97			
S-Q03R	6AKOX011.08	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net			
S-Q03R	6APPW000.60	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	net			
S-Q04R	6AGAR000.16	A,B	0 / 30	S	0 / 30	S	0 / 29	S	0 / 27	S	0 / 0	W	3 / 16	T																	VI	net		
S-Q04R	6ALEV151.90	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net			
S-Q04R	6AGAR001.78	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/					
S-Q05R	6ADIS001.24	A	0 / 17	S	0 / 18	S	0 / 17	S	0 / 20	S	0 / 0	W	0 / 14	S							0	S	0	S	0	S								
S-Q05R	6ADIS002.80	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-Q05R	6ADIS017.94	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-Q05R	6ADIS002.72	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/					
S-Q06R	6ABIP000.65	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	T	net			
S-Q06R	6ALEV143.86	A	0 / 57	S	0 / 57	S	0 / 56	S	1 / 54	S	0 / 0	W	4 / 40	S							4	T		0	S						combined with 6ABIP000.47 Sb,Pb,Ni,Zn			
S-Q06R	6ALEV151.29	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-Q07R	6ASAT000.00	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI				
S-Q07R	6ASAT000.03	A	0 / 18	S	0 / 18	S	0 / 18	S	0 / 20	S	0 / 0	W	3 / 14	T							1	S	0	S	0	S						Sb		
S-Q07R	6ASAT004.56	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S								
S-Q08R	6ABLC002.30	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	net			
S-Q08R	6ALEV130.29	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	VI	net			
S-Q08R	6ALEV131.52	A	0 / 57	S	0 / 57	S	0 / 56	S	0 / 54	S	0 / 0	W	4 / 38	S							2	T		0	S						Ni, Zn, PCB			
S-Q08R	6ALEV130.00	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S								
S-Q09R	6ARSS034.53	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-Q10R	6AFRY002.25	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-Q10R	6ARSS026.98	A	0 / 30	S	0 / 30	S	0 / 29	S	0 / 29	S	0 / 0	W	0 / 21	S							0	S	0	S	0	S								
S-Q11R	6AMCR000.20	A,B	0 / 8	J	0 / 8	J	0 / 8	J	0 / 8	J	0 / 0	W	1 / 7	J							0	S	0	S	0	S					NI	net		
S-Q11R	6AMCR000.55	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-Q11R	6AMCR007.46	A	0 / 21	S	0 / 21	S	0 / 21	S	0 / 20	S	0 / 0	W	4 / 13	P							1	S	0	S	0	S								
S-Q11R	6AMCR000.54	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S								
S-Q12R	6ARSS025.55	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S	0	S								
S-Q12R	6ARPC000.80	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net			
S-Q12R	6ARSS011.54	A	0 / 47	S	0 / 47	S	0 / 46	S	1 / 45	S	0 / 0	W	0 / 29	S							0	S	0	S	0	S								
S-Q12R	6ARSS011.64	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net			
S-Q12R	6ARSS014.15	A	0 / 13	S	0 / 13	S	0 / 13	S	0 / 13	S	0 / 0	W	0 / 13	S							0	S	0	S	0	S								

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**Chesapeake Bay and Small Coastal Basins
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REG & W I O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.		FISH TISSUE.				BIO MON	TYPE BIO STN	COMMENTS		
	IDENTIFICATION NUMBER	TYPE	TEMP	EUL	D.O.	pH	RTHOASULP	RPHORUL	CHLOHOLa	RTHOASULP	RPHORUL	CHLOHOLa	RTHOASULP	RPHORUL	CHLOHOLa	#b	#c	#d	#e	#f	#g								
T-C07E	7-BAK000.00	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	0 / 11	J																
T-C07E	7-BAK001.92	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	0 / 12	J																
T-C07E	7-BRK004.14	A	0 / 58	S	10 / 58	T	1 / 58	S	/	/	/	21 / 59	N																
T-C07E	7-CHS000.84	A	0 / 10	J	0 / 10	J	0 / 10	J	/	/	/	2 / 10	J																
T-C07E	7-NEW001.92	A	0 / 59	S	6 / 59	S	0 / 59	S	/	/	/	20 / 60	N																
T-C07E	7-NWB000.00	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	1 / 11	J																
T-C07E	7-NWB001.34	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	1 / 11	J																
T-C07E	7-POQ004.12	A	0 / 54	S	3 / 54	S	1 / 54	S	/	/	/	11 / 55	P																
T-C07E	7-POQ005.72	A	0 / 0	J	0 / 0	J	0 / 0	J	/	/	/	0 / 1	J																
T-C07E	7-POQ006.84	A	0 / 1	J	0 / 1	J	0 / 1	J	/	/	/	0 / 1	J																
T-C07E	7-SWB000.00	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	1 / 12	J																
T-C07E	7-SWB001.15	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	1 / 12	J																
T-C08E	7-BBY002.88	A	0 / 25	S	0 / 25	S	0 / 25	S	/	/	/	0 / 26	S																
T-C08E	7-CRY000.59	A	0 / 26	S	0 / 26	S	0 / 26	S	/	/	/	0 / 27	S					1	T									Antimony (Sb) 1995	
T-C08E	7-EBL000.01	A	0 / 27	S	0 / 27	S	0 / 27	S	/	/	/	0 / 28	S																
T-C08E	7-EBL001.15	A	0 / 27	S	0 / 27	S	0 / 27	S	/	/	/	0 / 28	S																
T-C08E	7-EBL002.54	A	0 / 27	S	1 / 27	S	0 / 27	S	/	/	/	4 / 28	S					1	T									Zinc 94	
T-C08E	7-LKN001.19	A	0 / 26	S	0 / 26	S	0 / 26	S	/	/	/	0 / 27	S																
T-C08E	7-LKN002.77	A	0 / 26	S	0 / 26	S	0 / 26	S	/	/	/	0 / 27	S					2	T									Antimony 95; Lead 93	
T-C08E	7-LNC000.68	A	0 / 26	S	0 / 26	S	0 / 26	S	/	/	/	0 / 27	S					1	T									Zinc 94	
T-C08E	7-LOB001.79	A	1 / 59	S	3 / 59	S	0 / 59	S	/	/	/	22 / 59	N																
T-C08E	7-LYN000.03	A	0 / 27	S	0 / 27	S	0 / 27	S	/	/	/	0 / 28	S																
T-C08E	7-THA000.76	A	1 / 59	S	6 / 59	S	1 / 59	S	/	/	/	31 / 57	N					3	T									Be, Cd, Pb 1995	
T-C08E	7-WES000.62	A	0 / 27	S	0 / 27	S	0 / 27	S	/	/	/	0 / 28	S																
T-C08E	7-WES001.68	A	0 / 27	S	0 / 27	S	0 / 27	S	/	/	/	0 / 28	S																
T-C08E	7-WES002.58	A	0 / 27	S	1 / 27	S	0 / 27	S	/	/	/	2 / 27	S					3	T									Sb 95; Silver, Zn 93	
T-C09R	7-XAE001.42	A	1 / 44	S	5 / 44	S	2 / 43	S	# / 43	T	/	3 / 42	S																
T-C10E	7-HLD002.67	A	1 / 45	S	5 / 45	S	0 / 44	S	/	/	/	25 / 44	N																
T-C10E	7-HUN001.88	A	0 / 48	S	0 / 48	S	0 / 47	S	/	/	/	6 / 45	S					2	T									Lead 95, Zinc 93	
T-C10E	7-MES006.92	A	1 / 47	S	12 / 47	Z	0 / 47	S	/	/	/	8 / 47	S															Natural Conditions	
T-C10R	7-SBB000.17	A/B	0 / 52	S	0 / 52	S	1 / 51	S	# / 52	T	/	9 / 50	P															NI	
T-C10R	7-XAZ000.30	B	0 / 4	J	0 / 4	J	0 / 4	J	4 / 4	T	/	1 / 3	J															NI	
T-C11E	7-LTH000.14	A	0 / 11	J	0 / 11	J	0 / 11	J	/	/	/	1 / 11	J																
T-C11E	7-OCB000.10	A	0 / 11	J	0 / 11	J	0 / 11	J	/	/	/	3 / 11	T																
T-C11E	7-OCN001.92	A	0 / 9	J	0 / 9	J	0 / 9	J	/	/	/	0 / 9	J																
T-C11E	7-OCN002.55	A	0 / 1	J	0 / 1	J	0 / 1	J	/	/	/	0 / 1	J																
T-C11E	7-OCN003.28	A	0 / 11	J	0 / 11	J	0 / 11	J	/	/	/	0 / 11	J																
T-C11E	7-OCN004.56	A	0 / 11	J	0 / 11	J	0 / 11	J	/	/	/	0 / 11	J																
T-C11E	7-ONB000.20	A	0 / 11	J	2 / 11	J	0 / 11	J	/	/	/	4 / 11	T																
T-C11E	7-ONB000.38	A	0 / 11	J	0 / 11	J	0 / 11	J	/	/	/	0 / 11	J																
T-C11E	7-ONB000.56	A	0 / 11	J	0 / 11	J	0 / 11	J	/	/	/	6 / 11	T																
T-C11E	7-OSB000.13	A	0 / 11	J	0 / 11	J	1 / 11	J	/	/	/	2 / 11	J																
T-C12E	7-PUN002.12	A	0 / 46	S	0 / 46	S	0 / 45	S	/	/	/	1 / 44	S																
T-C13E	7-NSS001.62	A	0 / 46	S	0 / 46	S	0 / 45	S	/	/	/	0 / 45	S																
T-C13E	7-UCH003.82	A	0 / 45	S	0 / 45	S	0 / 44	S	/	/	/	0 / 43	S																
T-C14E	7-HUG001.24	A	0 / 18	S	0 / 18	S	0 / 18	S	/	/	/	0 / 16	S																
T-C14E	7-THG000.36	A	0 / 18	S	0 / 18	S	0 / 18	S	/	/	/	0 / 16	S																
T-C14R	7-HUG004.40	A	0 / 17	S	6 / 17	Z	0 / 17	S	1 / 17	S	/	3 / 15	T*															Natural Conditions	
T-C15E	7-KNS000.40	A	0 / 18	S	0 / 18	S	0 / 18	S	/	/	/	0 / 16	S																
T-C16E	7-CCH000.00	A	0 / 49	S	0 / 49	S	1 / 48	S	/	/	/	4 / 47	S																
T-D01E	7-LTM000.80	A	0 / 11	J	0 / 11	J	0 / 11	J	/	/	/	1 / 10	J																
T-D02E	7-ASW003.36	A	1 / 47	S	4 / 47	S	0 / 47	S	/	/	/	5 / 46	S					1	T									Antimony 1995	

Chesapeake Bay and Small Coastal Basins
Appendix B for 1998 305(b) and 303(d) Reports

REG & W I O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.		FISH TISSUE.				BIO MON	TYPE BIO/STN	COMMENTS																																																																																																																																																																																																																																																																																																																																																															
	IDENTIFICATION NUMBER	TYPE	TEMP	SUL T	D.O.	pH	T O R S U L P S	R E S U L T	T H O R U S	R E S U L T	C H L O R O P H Y L L a	R E S U L T	C O L I F O R M	B A C T E R I A	# b	# c	# d	# e	# f	# g	R E S U L T	O X I D A T I O N	R E S U L T	M E T A L S				R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T

**Chesapeake Bay and Small Coastal Basins
Appendix B for 1998 305(b) and 303(d) Reports**

REG & W I O I N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.		FISH TISSUE.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	IDENTIFICATION NUMBER	TYPE	TEMP	# VIOLATIONS / # SAMPLES		pH	TOR	H O L	R E S	C O L	B A C	# b	# c	# d	# e	# f	# g																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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York River Basin
Appendix B for 1998 305(b) and 303(d) Reports

REGION	STATION	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		IDENTIFICATION NUMBER	TYPE	TEMP	SULF	DO	pH	TEMP	PHOS	CHLOR	SILICA	COPPER	BORON	#b	#c	#d	#e	#f	#g																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
VEGETATION	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY	WATER QUALITY

York River Basin
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REG & W I B O I N D	MONITORING STATIONS	CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT.				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS
		# VIOLATIONS / # SAMPLES						R E S U L T	T P H O R U S	R E S U L T	C H L O R O L A T E	R E S U L T	# b	# c	# d	# e	# f	# g	R E S U L T	R E S U L T	R E S U L T	R E S U L T						
		T E M P	T E M P	R E S U L T	D.O.	R E S U L T	pH																					
IDENTIFICATION NUMBER	Y E P	T E M P	T E M P	R E S U L T	D.O.	R E S U L T	pH	T P H O R U S	T P H O R U S	R E S U L T	C H L O R O L A T E	R E S U L T	# b	# c	# d	# e	# f	# g	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	R E S U L T	BIO MON	TYPE BIOL STN	COMMENTS	
P-F24E	MPN014.28	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	0	S	0	S									
P-F24R	8-HTQ003.77	A	0 / 10	J	2 / 10	J	0 / 10	J	0 / 9	J	/	/	1 / 9	J		0	S	0	S									
P-F25E	8-MPN004.39	A	0 / 68	S	0 / 68	S	0 / 65	S	1 / 25	W*	3 / 84	S	1 / 56	S		0	S	--										
P-F25E	MPN001.34	C, SS	/	/	/	/	/	/	/	/	/	/	/	/		0	S	0	S									
P-F25R	8-TST001.81	A	0 / 10	J	3 / 10	Z	0 / 10	J	0 / 19	S	/	/	2 / 9	J		0	S	0	S		0	S		0	S			Natural Conditions
T-F26E	8-PHB001.40	A	0 / 11	J	1 / 12	J	0 / 11	J	/	/	/	/	0 / 19	S														
T-F26E	8-PTK008.92	A	0 / 9	J	2 / 9	J	0 / 9	J	/	/	/	/	1 / 9	J														
T-F26E	8-QEN002.47	A	0 / 21	S	4 / 21	S	0 / 21	S	/	/	/	/	2 / 22	S														
T-F26E	8-QEN005.62	A	0 / 31	S	1 / 31	S	0 / 31	S	/	/	/	/	12 / 30	P*	1	T	2	T										Natural Conditions
T-F26E	8-YRK022.70	A	0 / 66	S	3 / 66	S	0 / 63	S	/	/	/	/	1 / 41	S														
T-F26E	8-YRK031.38	A	0 / 12	J	0 / 12	J	0 / 11	J	/	/	/	/	0 / 1	J														
T-F26E	8-YRK031.39	A	0 / 66	S	3 / 66	S	0 / 65	S	/	/	/	/	0 / 41	S														
T-F26E	8-YRK031.40	A	0 / 12	J	0 / 12	J	0 / 11	J	/	/	/	/	0 / 1	J														
T-F26E	LE4.1	A	/	/	/	/	/	/	/	/	1 / 69	S	/	/														
T-F26E	RET4.3	A	/	/	/	/	/	/	/	/	0 / 70	S	/	/														
T-F26E	RET4.3N	A	/	/	/	/	/	/	/	/	0 / 6	S	/	/														
T-F26E	RET4.3S	A	/	/	/	/	/	/	/	/	0 / 6	S	/	/														
T-F26R	01677000	A	0 / 10	J	0 / 9	J	0 / 10	J	0 / 10	J	/	/	0 / 0	W														
T-F26R	8-FRS001.21	B	0 / 3	J	0 / 3	J	0 / 3	J	0 / 4	J	/	/	1 / 4	J														
T-F27E	8-FEL000.19	A	0 / 45	S	0 / 45	S	0 / 45	S	/	/	/	/	1 / 47	J														
T-F27E	8-KNG004.46	A	0 / 48	S	6 / 48	S	0 / 48	S	/	/	/	/	9 / 50	P*														Natural Conditions
T-F27E	8-SRW001.08	A	0 / 8	J	0 / 8	J	0 / 8	J	/	/	/	/	0 / 9	J														
T-F27E	8-YRK001.33	A	0 / 12	J	2 / 12	J	0 / 12	J	/	/	/	/	0 / 1	J														
T-F27E	8-YRK001.64	A	0 / 66	S	18 / 66	Z	0 / 64	S	/	/	/	/	0 / 55	S														Natural Conditions
T-F27E	8-YRK001.86	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	0 / 1	J														
T-F27E	YRK002.92	C	/	/	/	/	/	/	/	/	/	/	/	/						0	S			0	S			
T-F27E	8-YRK011.13	A	0 / 12	J	0 / 12	J	0 / 12	J	/	/	/	/	0 / 1	J														
T-F27E	8-YRK011.14	A	0 / 65	S	9 / 65	S	0 / 62	S	/	/	/	/	1 / 41	S														
T-F27E	8-YRK011.24	A	0 / 12	J	0 / 12	J	0 / 11	J	/	/	/	/	0 / 1	J														
T-F27E	LE4.2	A	/	/	/	/	/	/	/	/	4 / 70	S	/	/														
T-F27E	LE4.2N	A	/	/	/	/	/	/	/	/	0 / 12	S	/	/														
T-F27E	LE4.2S	A	/	/	/	/	/	/	/	/	1 / 12	S	/	/														
T-F27E	LE4.3	A	/	/	/	/	/	/	/	/	0 / 70	S	/	/														
T-F27E	LE4.3N	A	/	/	/	/	/	/	/	/	0 / 6	S	/	/														
T-F27E	LE4.3S	A	/	/	/	/	/	/	/	/	0 / 6	S	/	/														
N-F06R	8-BRC001.88	A,B	0 / 18	S	0 / 18	S	0 / 18	S	1 / 16	S	/	/	6 / 14	P														
N-F06R	8-MTN000.96	A	0 / 20	S	0 / 20	S	0 / 20	S	1 / 18	S	/	/	7 / 16	N														
N-F07R	8-PLT002.82	A	0 / 18	S	0 / 18	S	0 / 18	S	1 / 17	S	/	/	5 / 14	P														
N-F07R	8-PMC009.85	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 18	S	/	/	7 / 15	N														
N-F07R	8-TRY004.98	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 17	S	/	/	5 / 14	P														
N-F15L	8-NIR012.99	A	0 / 1	J	0 / 1	J	0 / 1	J	0 / 1	J	/	/	0 / 1	J														
N-F15L	8-NIR016.09	A	0 / 1	J	0 / 1	J	0 / 1	J	0 / 1	J	/	/	0 / 1	J														
N-F15L	8-PNB000.05	A	0 / 1	J	0 / 1	J	0 / 1	J	0 / 1	J	/	/	0 / 1	J														
N-F15R	8-NIR003.96	A	0 / 45	S	0 / 45	S	0 / 45	S	0 / 43	S	/	/	0 / 42	S														
N-F16R	8-POR022.56	A	0 / 13	S	0 / 13	S	0 / 13	S	0 / 13	S	/	/	1 / 11	J														
N-F16R	8-POR008.97	A	0 / 45	S	0 / 45	S	0 / 45	S	0 / 43	S	/	/	1 / 43	S														
N-F16R	8-POR013.26	B	/	/	/	/	/	/	/	/	/	/	/	/														
N-F17R	8-MPN094.79	A,B	0 / 46	S	0 / 46	S	0 / 46	S	0 / 44	S	/	/	1 / 45	S														
N-F18R	8-MTA001.69	A,B	0 / 45	S	0 / 45	S	0 / 45	S	0 / 43	S	/	/	3 / 44	S														
N-F18R	8-TAR002.40	A	0 / 15	S	0 / 15	S	0 / 15	S	0 / 14	S	/	/	1 / 12	J														
N-F19R	8-STH004.37	A	0 / 16	S	1 / 16	S	1 / 16	S	0 / 16	S	/	/	0 / 14	S														
N-F20R	8-PCT002.29	A	0 / 45	S	1 / 45	S	0 / 45	S	8 / 43	T	/	/	2 / 44	S														
N-F21R	8-MPN073.75	A	0 / 44	S	0 / 44	S	0 / 44	S	0 / 42	S	/	/	0 / 41	S														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 / 9	J	0 / 9	J	6 / 9	T	0 / 9	J	0 / 0	/	2 / 9	J														
N-F21R	8-HER005.12	A	0 /																									

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REG & W I B O I N D	MONITORING STATIONS	CONVENTIONAL WATER COLUMN MONITORING DATA								OTHER MONITORING DATA																SEDIMENT.				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS
		# VIOLATIONS / # SAMPLES								R	T	P	H	C	R	C	B	# b	# c	# d	# e	# f	# g													
IDENTIFICATION NUMBER	T Y P E	T E M P	S U L T	D.O.	T	pH	T	L	P	S	T	O	L	C	R	M	E	R	E	R	M	E	R	E	R	M	E	R	E	R						
N-F21R	8-MPN054.17	A	0 / 197	S	0 / 194	S	20 / 197	Z	0 /	98	S	0 / 68	S	3 / 39	S						--	0	S	0	S								Natural Conditions			
N-F21R	8-RDY003.43	A	0 / 16	S	1 / 16	S	7 / 16	Z	0 /	16	S	0 / 0		1 / 13	S						0	S	0	S									Natural Conditions			
N-F22R	8-MAR004.41	A,B	0 / 17	S	0 / 17	S	1 / 17	S	0 /	17	S	/		1 / 16	S																					
N-F22R	8-BEV006.78	A	0 / 17	S	0 / 17	S	0 / 17	S	0 /	17	S	/		0 / 16	S																					

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REG & W I O N D	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA										SEDIMENT				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS									
	IDENTIFICATION NUMBER	TYPE	# VIOLATIONS / # SAMPLES						T	P	H	O	R	S	C	B	# b	# c	# d	# e	# f	# g																
			T	E	S	U	L	T															P	H	O	R				S	C	B	# b	# c	# d	# e	# f	# g
TEMP	ESULT	ESULT	ESULT	ESULT	pH	TOTAL	PHOSPH	ESULT	CHLOR	ESULT	COLIFORM	BACTERIA	ESULT	ME TCAE	ESULT	ME TCAE	ESULT	ME TCAE	ESULT	ME TCAE	ESULT	ME TCAE	ESULT	ME TCAE														
S-N01R	9-HTN009.20	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N02R	9-NEW187.46	A	0 /	57	S	0 /	57	S	0 /	57	S	1 /	55	S	0 /	0	W	3 /	40	S	1	S	0	S	SI	net												
S-N02R	9-NEW188.71	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net												
S-N02R	9-WLS002.57	A	0 /	30	S	0 /	30	S	0 /	30	S	0 /	29	S	0 /	0	W	1 /	19	S	0	S	0	S	NI													
S-N02R	9-WLS006.60	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N03R	9-FXC000.84	A	0 /	29	S	0 /	29	S	0 /	29	S	0 /	28	S	0 /	0	W	1 /	20	S	0	S	0	S														
S-N04R	9-LVR001.34	A	0 /	21	S	0 /	21	S	0 /	21	S	1 /	19	S	0 /	0	W	0 /	13	S	3,1	T	0	S			Ni,Sb											
S-N04R	9-PBC002.69	A	1 /	19	S	0 /	19	S	0 /	19	S	3 /	19	T	0 /	0	W	1 /	12	J	1	S	0	S			Zn											
S-N04R	K7900000	A	0 /	43	S	0 /	43	S	0 /	41	S	0 /	43	S	0 /	0	W	4 /	40	S							New R sampled by NC											
S-N04R	K9900000	A	0 /	43	S	0 /	43	S	0 /	41	S	1 /	43	S	0 /	0	W	5 /	40	S							Little R sampled by NC											
S-N04R	NEW179.98	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N04R	NFH039.18	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N05R	9-EKC003.78	A	5 /	29	S	0 /	29	S	0 /	29	S	2 /	29	S	0 /	0	W	2 /	18	T	0	S	0	S	0	S	0	S										
S-N05R	9-EKC004.38	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net												
S-N06R	9-CST001.31	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net												
S-N06R	9-CST002.64	A,B	0 /	21	S	0 /	21	S	0 /	21	S	1 /	19	S	0 /	0	W	1 /	13	S	3,2,1	T			NI	net	Zn,Ni,Sb											
S-N06R	9-CST010.18	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net												
S-N06R	9-CST013.29	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net												
S-N06R	9-CST016.82	A	0 /	21	S	0 /	21	S	0 /	21	S	0 /	19	S	0 /	0	W	1 /	11	J	2,1	T	0	S	0	S	0	S	Ni,Sb/Comb w/ 9-CST015.07									
S-N06R	NEW140.02	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N06R	NEW148.23	C,SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N06R	NEW156.55	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N06R	9-NEW148.23	A	0 /	55	S	0 /	55	S	0 /	55	S	1 /	54	S	0 /	0	W	1 /	35	S	0	S	0	S	0	S	0	S	Ni									
S-N07R	9-CRK003.00	A	0 /	30	S	0 /	30	S	0 /	30	S	1 /	29	S	0 /	0	W	1 /	18	S	1	S	0	S				Sb										
S-N08R	9-MRN001.42	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	net												
S-N08R	9-NEW 107.52	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net												
S-N08R	9-NEW107.51	A	0 /	43	S	0 /	43	S	0 /	42	S	0 /	39	S	0 /	0	W	3 /	23	S	2,1,1	T	0	S				Zn,Sb,Pb										
S-N08R	9-NEW127.49	A	0 /	57	S	0 /	57	S	0 /	57	S	1 /	52	S	0 /	0	W	4 /	37	S	1	S	0	S	0	S	0	S	Sb									
S-N08R	NEW117.42	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N08R	NEW124.51	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N08R	NEW136.35	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N09R	9-CPL003.10	A	0 /	31	S	0 /	31	S	0 /	31	S	1 /	29	S	0 /	0	W	3 /	19	T	0	S	0	S	0	S	0	S	Zn									
S-N09R	9-CPL018.37	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net		Additional Data Required										
S-N10R	9-RSF000.04	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net												
S-N11R	9-RDC009.00	A	0 /	19	S	0 /	19	S	0 /	19	S	0 /	17	S	0 /	0	W	1 /	13	S	0	S	0	S														
S-N11R	9-RDC033.24	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	net												
S-N11R	9-RDC033.39	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	net												
S-N11R	9-RDC044.87	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	net												
S-N12R	9-CVR001.17	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	SI	net												
S-N13R	9-RIC034.08	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	net												
S-N14R	9-RIC000.50	A	0 /	28	S	0 /	28	S	0 /	28	S	1 /	19	S	0 /	0	W	2 /	15	T	2	T	0	S				Sb										
S-N15R	9-LRI001.62	A	0 /	24	S	0 /	24	S	0 /	24	S	1 /	16	S	0 /	0	W	2 /	20	S	3,1,1	T	0	S	0	S	0	S	Zn,Sb,Sb/comb w/ 9-LRI000.40									
S-N16L	NEW100.54	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N17R	PKC017.11	C	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N21R	LRV002.91	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N21R	LRV026.31	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N21R	LRV002.91	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N25R	9-WLK044.06	A	0 /	30	S	0 /	30	S	0 /	30	S	0 /	28	S	0 /	0	W	0 /	19	S	0	S	0	S														
S-N25R	WLK012.05	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N25R	WLK026.12	SS	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/														
S-N26R	9-KBL007.29	A	0 /	30	S	0 /	30	S	0 /	30	S	0 /	29	S	0 /	0	W	2 /	20	S	1	S	0	S				Ni										
S-N30R	9-WFC034.82	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	NI	ref		Ni										

New River Basin
Appendix B for the 1998 305(b) and 303(d) Reports

REG & WID O I N	MONITORING STATIONS		CONVENTIONAL WATER COLUMN MONITORING DATA						OTHER MONITORING DATA												SEDIMENT				FISH TISSUE.				BIO MON	TYPE BIOL STN	COMMENTS
	IDENTIFICATION NUMBER	TYPE	# VIOLATIONS / # SAMPLES				pH	TOL	PHORUS	EHLPLORYa	RUL	COLITFORMIA	BACTESURILE	#b	#c	#d	#e	#f	#g												
			TEMP	RESULT	D.O.	RESULT														TEMP	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT			
S-N31R	9-HCC001.40	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net	
S-N32R	9-WFC016.45	A	0 / 29	S	0 / 29	S	0 / 29	S	0 / 28	S	0 / 0	W	0 / 20	S							0	S	0	S					SI	net	
S-N33R	9-LAC000.92	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	MI	net	
S-N36R	9-BST023.05	A,B	0 / 57	S	0 / 57	S	0 / 56	S	10 / 55	T	0 / 0	W	6 / 32	P							0	S	0	S					VI	net	
S-N36R	9-BST029.57	A	0 / 20	S	0 / 20	S	0 / 19	S	0 / 18	S	0 / 0	W	2 / 13	T							0	S	0	S							
S-N37R	9-LRR001.39	B	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/			
S-N37R	9-LRR002.19	A	0 / 26	S	11 / 28	N	0 / 25	S	2 / 24	S	0 / 0	W	6 / 20	N							5,2,1	T	0	S							
W-N14R	9-RIC000.50	A	0 / 28	S	0 / 28	S	0 / 28	S	1 / 19	S	0 / 0		2 / 15	T	0	S	0	S	0	S	1	T	0	S							
W-N15R	9-LRI001.62	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 4	J	0 / 0		0 / 3	J	0	S	0	S	0	S	1	T	0	S							
W-N15R	9-LRI000.40	A	0 / 24	S	0 / 24	S	0 / 24	S	1 / 16	S	0 / 0		2 / 14	T	0	S	0	S	0	S	1	T	0	S							
W-N16R	9-NEW098.32	A	0 / 64	S	3 / 64	S	0 / 64	S	0 / 64	S	0 / 0		4 / 61	S	0	S	0	S	0	S	2	T	0	S							
W-N16R	9-NEW107.51	A	0 / 43	S	0 / 43	S	0 / 42	S	0 / 39	S	0 / 0		3 / 23	S	0	S	0	S	0	S	3	T	0	S							
W-N16R	9-NEW106.83	A	0 / 12	J	0 / 12	J	0 / 12	J	0 / 0	W	0 / 0		3 / 12	J	0	S	0	S	0	S	3	T	0	S							
W-N17R	9-PKC011.11	A,B	0 / 19	S	0 / 19	S	0 / 19	S	0 / 0	W	0 / 0		1 / 17	S	0	S	0	S	0	S	2	T	0	S							
W-N17R	9-PKC009.29	A,B	0 / 19	S	0 / 19	S	1 / 19	S	0 / 0	W	0 / 0		3 / 18	T	0	S	0	S	0	S	1	T	0	S							
W-N17R	9-PKC007.82	A,B	0 / 7	J	0 / 7	J	0 / 7	J	0 / 0	W	0 / 0		2 / 6	J	0	S	0	S	0	S	4	T	0	S							
W-N17R	9-PKC004.65	A	0 / 62	S	0 / 62	S	0 / 62	S	0 / 59	S	0 / 0		5 / 58	S	0	S	0	S	0	S	0	S	0	S							
W-N18R	9-NEW081.72	A	0 / 61	S	0 / 61	S	0 / 61	S	0 / 59	S	0 / 0		7 / 57	S	0	S	0	S	0	S	2	T	0	S							
W-N18R	9-NEW077.36	SS	0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0	S	0	S	0	S	3	T	0	S							
W-N18R	9-CBC006.35	A,B	0 / 60	S	0 / 60	S	0 / 60	S	0 / 58	S	0 / 0		21 / 56	N	0	S	0	S	0	S	0	S	0	S							
W-N18R	9-CBC004.38	A,B	0 / 60	S	0 / 60	S	0 / 60	S	56 / 58	T	0 / 0		15 / 56	P	0	S	0	S	0	S	0	S	0	S							
W-N18R	9-CBC001.00	B	0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0	S	0	S	0	S	0	S	0	S							
W-N19R	9-LRV059.33	A	0 / 3	J	0 / 3	J	0 / 3	J	0 / 0	W	0 / 0		0 / 3	J	0	S	0	S	0	S	0	S	0	S							
W-N20R	9-DDD004.64	A	3 / 20	T*	0 / 20	S	0 / 20	S	0 / 0	W	0 / 0		5 / 18	P	0	S	0	S	0	S	0	S	0	S							
W-N20R	9-DDD002.62	A	2 / 8	J	0 / 8	J	0 / 8	J	0 / 0	W	0 / 0		1 / 6	J	0	S	0	S	0	S	0	S	0	S							
W-N21R	9-MLC005.44	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 0	W	0 / 0		11 / 18	N	0	S	0	S	0	S	1	T	0	S							
W-N21R	9-MLC002.59	A	0 / 7	J	0 / 7	J	0 / 7	J	0 / 0	W	0 / 0		3 / 6	T	0	S	0	S	0	S	0	S	0	S							
W-N21R	9-LRV000.34	A	0 / 19	S	0 / 19	S	0 / 19	S	0 / 0	W	0 / 0		2 / 18	T	0	S	0	S	0	S	0	S	0	S							
W-N22R	9-STE006.69	B	0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0	S	0	S	0	S	0	S	0	S							
W-N22R	9-STE002.41	A	0 / 19	S	0 / 19	S	2 / 19	T*	0 / 0	W	0 / 0		1 / 18	S	0	S	0	S	0	S	0	S	0	S							
W-N22R	9-BCK009.47	A	0 / 18	S	0 / 18	S	0 / 17	S	0 / 0	W	0 / 0		14 / 16	N	0	S	0	S	0	S	0	S	0	S							
W-N23R	9-SNK012.06	A,B	2 / 9	J	0 / 9	J	0 / 9	J	0 / 0	W	0 / 0		0 / 8	J	0	S	0	S	0	S	0	S	0	S							
W-N23R	9-SNK005.38	A	2 / 9	J	0 / 9	J	0 / 9	J	0 / 0	W	0 / 0		1 / 9	J	0	S	0	S	0	S	0	S	0	S							
W-N23R	9-NEW057.83	SS	0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0	S	0	S	0	S	1	T	0	S							
W-N23R	9-NEW056.22	A	0 / 61	S	0 / 61	S	1 / 61	S	0 / 59	S	0 / 0		1 / 57	S	0	S	0	S	0	S	2	T	0	S							
W-N24R	9-LRY000.28	A	1 / 4	J	0 / 4	J	0 / 4	J	0 / 0	W	0 / 0		1 / 4	J	0	S	0	S	0	S	0	S	0	S							
W-N25R	9-WLK004.34	A	0 / 20	S	0 / 20	S	0 / 20	S	0 / 0	W	0 / 0		0 / 19	S	0	S	0	S	0	S	0	S	0	S							
W-N27R	9-LWK000.77	A	1 / 13	S	0 / 13	S	0 / 13	S	0 / 1	W	0 / 0		2 / 13	T	0	S	0	S	0	S	0	S	0	S							
W-N28R	9-SNC005.04	B	0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0	S	0	S	0	S	0	S	0	S							
W-N28R	9-SNC002.88	B	0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0	S	0	S	0	S	0	S	0	S							
W-N28R	9-SNC000.20	A,B	0 / 14	S	0 / 14	S	0 / 14	S	0 / 0	W	0 / 0		0 / 14	S	0	S	0	S	0	S	2	T	0	S							
W-N29R	9-NEW040.97	SS	0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0	S	0	S	0	S	1	T	0	S							
W-N29R	9-NEW033.36	SS	0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0 / 0		0	S	0	S	0	S	2	T	0	S							
W-N29R	9-NEW030.15	A	2 / 61	S	0 / 61	S	0 / 61	S	0 / 58	S	0 / 0		2 / 58	S	0	S	0	S	0	S	1	T	0	S							
W-N32R	9-WFC000.20	A	0 / 22	S	0 / 22	S	0 / 22	S	0 / 0	W	0 / 0		2 / 19	T	0	S	0	S	0	S	1	T	0	S							
W-N34R	9-RHC000.08	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 0	W	0 / 0		1 / 4	J	0	S	0	S	0	S	0	S	0	S							
W-N35R	9-ADR000.13	A	0 / 4	J	0 / 4	J	0 / 4	J	0 / 0	W	0 / 0		0 / 4	J	0	S	0	S	0	S	0	S	0	S							

APPENDIX C

SIGNIFICANT LAKES BY REGION

Northern Regional Office - 11 Lakes

Able Lake	Stafford Co.	185 (Acres)	PWS (Public Water Supply)
Aquia Reservoir (Smith Lake)	Stafford Co.	219	PWS
Beaverdam Reservoir	Loudoun Co.	350	PWS
Burke Lake	Fairfax Co., VDGIF	218	
Goose Creek Reservoir	Loudoun Co.	140	PWS
Lake Manassas	Pr. William Co.	741	PWS
Motts Run Reservoir	Fairfax Co.	160	PWS
Mountain Run Lake	Culpeper Co.	75	PWS
Ni Reservoir	Spotsylvania Co.	400	PWS
Occoquan Reservoir	Fairfax Co.	1700	PWS
Pelham Lake	Culpeper Co.	253	PWS

Piedmont Regional Office - 25 lakes

Airfield Pond	Sussex Co., VDGIF	105	
Amelia Lake	Amelia Co., VDGIF	110	
Briery Creek Lake	Pr. Edward Co., VDGIF	850	
Brunswick Lake	Brunswick Co., VDGIF	150	
Lake Chesdin	Chesterfield Co.	3196	PWS
Chickahominy Lake	Charles City Co.	1500	PWS
Lake Conner	Halifax Co., VDGIF	111	
Diascund Reservoir	New Kent Co.	1700	PWS
Emporia Lake	Greensville Co.	210	PWS
Falling Creek Reservoir	Chesterfield Co.	110	
Lake Gaston	Brunswick Co.	20300	
Gordon Lake	Mecklenburg Co., VDGIF	157	
Great Creek Reservoir	Lawrenceville	305	
Halifax Reservoir (Bannister Lake)	Halifax Co.	410	PWS
Holiday Lake	Appomattox Co.	145	
Kerr Reservoir	Halifax Co., ACOE	48968	PWS
Keysville Lake	Charlotte Co.	42	PWS
Lunenburg Beach lake	Town of Victoria	13	PWS
Modest Creek Reservoir	Town of Victoria	29	PWS
Nottoway Falls Lake	Lunenburg Co.	60	PWS
Nottoway Lake	Nottoway Co.	188	
Nottoway Pond	Nottoway Co.	65	PWS
Troublesome Creek Res. (SCS Impoundment #2)	Buckingham Co.	58	PWS
Swift Creek Lake	Chesterfield Co.	156	
Swift Creek Reservoir	Chesterfield Co.	1800	PWS

Southwest Regional Office - 9 Lakes

Appalachia Res.	Wise Co.	17	PWS
Big Cherry Lake	Wise co.	76	PWS
Byllsby Reservoir	Carroll Co.	335	
J.W. Flannigan Res.	Dickenson Co., ACOE	1143	PWS
Hungry Mother Lake	Smyth Co.	108	
Lake Keokee	Lee Co., VDGIF	100	
Laurel Bed Lake	Russell Co., VDGIF	300	
North Fork Pound Res.	Wise Co., ACOE	154	PWS
South Holston Res.	Washington co., TVA	7580	PWS

Tidewater Regional Office - 21 Lakes

Lake Cahoon	Suffolk City	508	PWS
Lake Burnt Mills	Isle of Wight Co.	610	PWS
Harwood Mill Pound	York Co.	300	PWS
Lake Joyce	Virginia Beach	150	
Lake Kilby	Suffolk City	226	PWS
Lawson Reservoir	Norfolk city	98	PWS
Lee Hall Reservoir	Newport News	230	PWS
Little Creek Res.	Norfolk City	185	PWS
Little Creek Res.	James City Co.	860	PWS
Lone Star Lake F	Suffolk City	20	PWS
Lone star Lake G	Suffolk City	50	PWS
Lone Star Lake I	Suffolk City	39	PWS
Lake Meade	Suffolk City	511	PWS
Lake Prince	Suffolk City	775	PWS
Skiffes Creek Res.	Newport News	86	PWS
Lake Smith	Norfolk City	222	PWS
Speights Run Lake	Suffolk City	94	PWS
Stumpy lake	Virginia Beach	210	PWS
Waller Mill Res.	York co.	315	PWS
Lake Whitehurst	Norfolk City	458	PWS
Lake Wright	Norfolk City	35	PWS

Valley Regional Office - 13 Lakes

Lake Anna	Louisa Co.	12998	
Beaver Creek Res.	Albemarle Co.	104	PWS
Mount Jackson Res.	Shenandoah Co.	0.7	PWS
Coles Run Res.	Augusta Co., USFS	9	PWS
Elkhorn Lake	Augusta Co., USFS	55	PWS
Northeast Creek Res.	Louisa Co.	49	PWS
Ragged Mount Res.	Albemarle Co.	54	PWS
Rivanna Res.	Albemarle Co.	390	PWS
Staunton Dam Lake	Augusta Co.	30	PWS
Strasburg Reservoir	Shenandoah Co.	5.3	PWS
Switzer Lake	Rockingham Co., USFS	110	PWS
Sugar Hollow Res.	Albemarle Co.	47	PWS
Totier Creek Res.	Albemarle Co.	66	PWS

West Central Regional Office - 25 Lakes

Beaverdam Creek Res.	Bedford Co.	123	PWS
Bedford Reservoir	Bedford Co.	28	PWS
Brookneal Reservoir	Campbell Co.	25	PWS
Carvin Cove Reservoir	Botetourt Co.	630	PWS
Cherrystone Lake	Pittsylvania Co.	105	PWS
Claytor Lake	Pulaski Co.	4483	PWS
Clifton Forge Res.	Alleghany Co., USFS	16	PWS
Fairstone Lake	Henry co.	168	
Gatewood Res.	Pulaski co.	162	PWS
Georges Creek Res.	Pittsylvania Co.	1	PWS
Graham Creek Res.	Amherst Co.	50	PWS
Hogan Lake	Pulaski Co.	40	PWS
Leesville res.	Bedford Co.	3400	
Little River Res.	Montgomery Co.	113	
Martinsville Res.	Henry	220	PWS
Lake Moomaw	Bath Co., USFS	2430	PWS
Narrows Reservoir	Bland Co.	0.5	PWS
Pedlar Lake	Amherst Co.	75	PWS
Philpott Res.	Henry Co., ACOE	2879	PWS
Roaring Fork	Pittsylvania Co.	19	PWS
Rucker Mountain	Patrick Co.	0.2	PWS
Smith Mountain Lake	Bedford Co.	19992	PWS
Stonehouse Creek Res.	Amherst Co.	125	
Talbott Reservoir	Patrick Co.	165	
Thrashers Creek Res.	Amherst Co.	110	

Total 79 Lakes statewide.